D0301-014

FINAL ENGINEERING REPORT

FOR THE

MEDIUM RESOLUTION INFRA-RED (MRIR) EXPERIMENT

ENGINEERING MODEL DIGITAL ELECTRONICS TELEMETRY UNIT

FOR

NIMBUS "B"

1 November 1965 - 1 April 1966

CONTRACT NO. NAS5-9699

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SUMMARY

The object of this report is to describe in detail the overall design aspects of the Engineering Model MRIR Telemetry Unit, and to present design information on the Bench Test Equipment which was modified for the MRIR Telemetry Unit. The Bench Test Equipment was originally designed and fabricated for the MRIR Telemetry Unit contained in the NIMBUS "C" Spacecraft.

The final engineering design report is intended to establish information on the telemetry unit operation, to define engineering problems uncovered during functional testing, and to recommend improvements to be incorporated into succeeding units. Data pertinent to maintaining the MRIR Telemetry Unit is also presented within this report.

The finished Engineering Model MRIR Telemetry Unit had slight deviations from the information presented in the Design Study Report, CalComp Document D0301-013, dated 31 December 1965. The deviations, electrical in nature, were brought about because of problems uncovered during functional test. These problems involved circuit changes or logic changes. These were as follows:

a. Noise pulses on the second stage flip-flop input of the commutation ring counter.

b. 200-kc input filter network.

c. A/D Converter comparator amplifier compensation.

d. A/D Converter precision operational amplifier compensation.

e. MOS-FET device failures during functional test.

Solutions and recommendations pertaining to these problems are explained in the main test of this report.

The initial engineering model design approach was straightforward and relatively complete. Except for necessary changes to ensure reliable operation, only two recommendations are made as improvements. One improvement recommendation is the availability of two MOS-FET devices per analog input channel (requires two additional TO-5 packages), and the other improvement is to provide better noise isolation on the second stage commutation ring counter.

The functional test of the Engineering Model MRIR Telemetry Unit was performed with the aid of the modified NIMBUS "C" Bench Test Equipment. The BTE provided the input signals and captured the responses which were processed to provide visual inspection capability for determining the operation of the telemetry unit. Inasmuch as the BTE was used to test the telemetry unit, the very act of its testing capability provided data which indicated that the BTE was performing in a manner which constituted acceptance of its own operability. Therefore, the modification to the BTE has been tested through actual use of the equipment.

In concluding this summary, it is felt that the Engineering Model MRIR Telemetry Unit and the Bench Test Equipment meet the requirements of the GSFC-NASA specification for the Medium Resolution IR (MRIR) Experiment Engineering Model for the NIMBUS "B" Spacecraft. The design, fabrication, assembly, and testing of the telemetry unit did not present any major problems that could not be simply and easily rectified. The mechanical design is complete and all parts were assembled without any modifications being required. With the inclusion of the suggested recommendations, prototype and flight model telemetry units may be constructed and tested in the same manner as the Engineering Model MRIR Telemetry Unit. The BTE and its new modifications have been checked out and found to be sufficient for testing the telemetry unit. No further additions or modifications are to be incorporated into the BTE.

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SECTION 1

INTRODUCTION

The Engineering Model MRIR Telemetry Unit has been designed, fabricated, functionally tested, and delivered. A final engineering report covering the history, fabrication, and testing of the completed subsystem is presented herein. In addition, this report shall cover the Bench Test Equipment which was modified for the NIMBUS "B" telemetry unit.

1.1 SCOPE

This final report contains the data which is pertinent to the completed Engineering Model MRIR Telemetry Unit. The report is intended to cover the electrical, mechanical, and functional testing aspects of the completed subsystem, provide recommendations for improvement on following units, and to provide sufficient data for maintenance purposes. Also, a functional and physical description of the modified Bench Test Equipment shall be included in this report.

1.2 HISTORY OF CONTRACT NAS5-9699

A CPIF contract with an incentive clause for cost and delivery was awarded to California Computer Products, Inc.,

(CalComp) on 1 November 1965. The overall object of the contract was to perform a design study on a Medium Resolution Infra-red (MRIR) Telemetry Unit which had been designed by NASA for the NIMBUS "B" Spacecraft, to review and recommend improvements in the design, and to generate a pre-prototype engineering model based on the results presented and agreed to in the design study review. In addition to the telemetry unit, the contract required that one set of NIMBUS "C" MRIR-PCM Bench Test Equipment (BTE) be modified for use with the NIMBUS "B" Telemetry Unit. Manuals to support the BTE for both operation and maintenance purposes were also required as part of this contract. The contract called for completion of the hardware fabrication and final delivery on or before 31 March 1966.

The delivery of the Engineering Model MRIR Telemetry Unit was fulfilled with a final sell-off demonstration test to an authorized representative of the Government as appointed by NASA on 1 April 1966.

To aid in the design study of the MRIR Telemetry Unit, NASA shipped to California Computer Products, a breadboard version of the design on 9 November 1965. The breadboard consisted of two major parts, the power supply and the telemetry unit logic section with associated drawings and test aids. With the aid of the breadboard, careful analysis and relying on the past experience of the NIMBUS "C" MRIR Telemetry Unit, CalComp generated a design study report which assessed the submitted design for the proposed

telemetry unit. The design study report pointed out potential trouble areas, recommended improvements, and presented a hardware packaging concept with thermal and mechanical analytical data.

The preliminary design study report was submitted to NASA on 31 December 1965 for their review. On 6 January 1966, three representatives from NASA consisting of the contracting officer, the technical officer, and the telemetry unit designer met with CalComp representatives at CalComp to discuss the recommendations set forth in the design study report. At this meeting, it was determined what recommendations would be adopted. It was also decided that all suggested improvements which were adopted were within the scope of the original contract; therefore, no negotiations were required to receive additional funding for work considered to be beyond the intent of the original contract. With the formal approval of NASA on 25 February 1966, CalComp initiated the orders to produce an engineering model of the MRIR Telemetry Unit. Parts were ordered, artwork for the printed circuit modules was completed, functional test specifications were written, and supporting test equipment was developed and fabricated. The BTE design was firmed up as a result of the agreement reached on the MRIR design recommendations.

All parts contained within the Engineering Model MRIR Telemetry Unit were ordered from vendors with the exception of the flat pack integrated circuits which were Government-

furnished. The GFE IC's were functionally tested at CalComp prior to being soldered to the printed circuit boards.

On 2 March 1966, an interface agreement meeting conducted by General Electric was held at Goddard Space Flight Center in Greenbelt, Maryland. In attendance were representatives from General Electric, Santa Barbara Research, California Computer Products, Inc., and NASA. The purpose of the meeting was to establish interface requirements among the equipment suppliers. Since General Electric has the responsibility for system integration, General Electric conducted the meeting. The final results of the meeting were to be compiled into separate documents specifically directed to the participating equipment manufacturers.

After the establishment of interface requirements, the task at hand was to fabricate, assemble, and test the Engineering Model MRIR Telemetry Unit. The telemetry unit consists of a magnesium chassis and seven printed circuit cards. The procurement of parts for the assembly did not present delivery problems. The IC's were hand soldered to the printed circuit boards even though a resistive soldering machine was slated to be used for this job. Using the soldering machine, a sample IC board was prepared with dummy IC's which were attached to the printed circuit board. The sample was submitted to NASA for review and tests. NASA tests showed that the soldering was unsuitable at this time; however, NASA recommended several improvements in

using the soldering machine. The NASA laboratory report indicated that once the right combination of heat, solder content, solder deposition, and bonding pad area were determined, the solder bond would be sufficient to fulfill NASA soldering requirements.

As each printed circuit board was completed, it was subjected to a comprehensive static test to ensure that no damage occurred to the board or its components during the assembly. At the completion of the board test, the boards were inserted into the wire harness connectors contained in the chassis to perform the system functional test with the aid of the BTE. The functional test of the boards, individually as well as combined within the system, uncovered malfunctions for which corrective action was initiated. The details of the malfunctions and new recommendations are contained in the main body of this report. Prior to delivery, the engineering model was subjected to a thermal cycle test which covered the range from minus 10°C to plus 60°C. The results of this testing are contained in Section 4. As it was stated before, the acceptance test which constituted delivery was performed on 1 April 1966 at the CalComp facility. On 5 April 1966, the engineering model was presented to the NASA technical officer at the Goddard Space Flight Center. Power and input signals were applied, and the Engineering Model MRIR Telemetry Unit responded by presenting the correct data.

From the start of the contract to the hardware delivery of the Engineering Model MRIR Telemetry Unit, the total time frame for the design review, fabrication, assembly, and test of the telemetry unit was five months and one day.

1.3 ENGINEERING MODEL TELEMETRY UNIT GENERAL DESCRIPTION

The NIMBUS "B" MRIR Telemetry Unit interfaces with the MRIR Radiometer Electronics Unit to convert analog data to a serialized digital format. The logic circuitry within the MRIR Telemetry Unit samples in sequence each of five radiometer output channels. The analog information is gated to an Analog-to-Digital (A/D) Converter Unit where 34.7 A/D conversions per second are performed on each channel input. The A/D conversion is performed with an accuracy of 1 part in 256 (8 bit accuracy).

The output of the A/D Converter is formatted with a frame synchronization word to produce a 28.8 millisecond frame length. The serial bit-stream frame consists of one 8-bit frame synchronization word (10111000) and five 8-bit digitized conversions of the analog radiometer data (one word for each of the five channels). The formatted data is transmitted in a split-phase waveform to a satellite digital recorder at a 1.66-kc bit rate (208 cps data word rate). The least significant bit for each word is transmitted first.

1.4 BENCH TEST EQUIPMENT GENERAL DESCRIPTION

The MRIR Telemetry Unit Digital Subsystem Bench Test Equipment is designed to facilitate the functional testing of the Engineering Model MRIR Telemetry Unit. The Bench Test Equipment generates the clock frequencies, analog voltages, and primary power required by the telemetry unit. By routing all interface signals through the test point panel, an evaluation of the various input/output signals can be made. The primary output of the telemetry unit subsystem, a split-phase code modulated signal, is decommutated and made available as a visual display.

Additional features, such as current monitoring facilities, incremental voltage sources, and dummy loads are contained in the test equipment, minimizing the accessory equipment required for a thorough test.

The digital electronics contained in the test equipment is mechanized from basic modules for ease of maintenance and replacement. To aid in maintaining the test equipment, miscellaneous remote controls and indicators are brought to the front panel of the electronics drawer.

The d-c voltages required to operate both the test equipment and the unit under test are provided by modular power supplies housed in the test console.

SECTION 2

ELECTRONIC REVIEW

2.1 PRINTED CIRCUIT BOARDS

The final design of the MRIR Telemetry Unit contains seven (7) printed circuit boards (PCB's). Five of the PCB's contain the electronics to initiate and perform the function for converting the analog input information into a digital format. The remaining two PCB's provide the necessary secondary power levels which are generated from a primary input voltage source of a nominal minus 24.5 volts. A brief description of each module and its function is presented below.

a. Analog Input - 25-kc Generator

   This board contains six MOS-FET devices (only five are used) which gate the analog information to the A/D Converter. A five flip-flop ring counter provides the commutating control. In addition, this board generates a 25-kc clock signal by using three flip-flops to divide the 200-kc input by eight.

b. A/D Converter

This board contains the precision voltage supply, the comparator amplifier, constant current sources, transistor switches, and a precision resistor-ladder network to accomplish the analog-to-digital conversion.

c. A/D Data Control

This board contains two 8-flip-flop registers. One register retains the data after the A/D conversion. The other register provides the control signal to successively turn on each current source. Depending on whether the analog voltage is greater than or less than the voltage generated by the ladder network, will determine whether a selected current source should be left on or turned off. This module also contains the Frame Sync Inhibit logic which changes the least significant bit to a "one" if analog data is converted to have the same bit pattern as the Frame Sync word.

d. Encode - Timing Generator

This board contains nine flip-flops which are used to provide timing control. Six flip-flops are used to divide a 10-kc input signal to 1.66 kc (one bit time) and 208 cps (one word time). A transfer pulse is generated to gate the converted information from the data register

on the A/D Data Control board to an output data shift register on the Frame Sync-Data Output board. In addition to the transfer pulse, a second timing pulse (ENCODE pulse) is generated. The ENCODE pulse clears the A/D data register, resets the A/D shift register, and starts the A/D conversion of new input data.

e. Frame Sync - Data Output

This board generates the Frame Sync word (10111000) every sixth word time. The function of the Frame Sync word is to provide a basis for synchronization when decommutating the telemetry data transmitted to a ground station. As was mentioned before, an 8-bit flip-flop shift register is contained on this board to provide the serial data output to two redundant data output buffer drivers. The data is transmitted in a split-phase waveform as shown in Figure 2-1.

f. DC/DC Converter No. 1

This board is one of two power supply boards which provides the secondary voltage levels. These levels are +3.2v, +6v, -6v, -12v, and -18v. Contained on this board are the primary power relay, flux oscillator, power transformer, and secondary voltage diode rectifiers. The DC/DC No. 1 board was designed so that all oscillating signals would be confined on this board and not be coupled into the wiring harness by sending the oscillating signals to another board for conditioning.

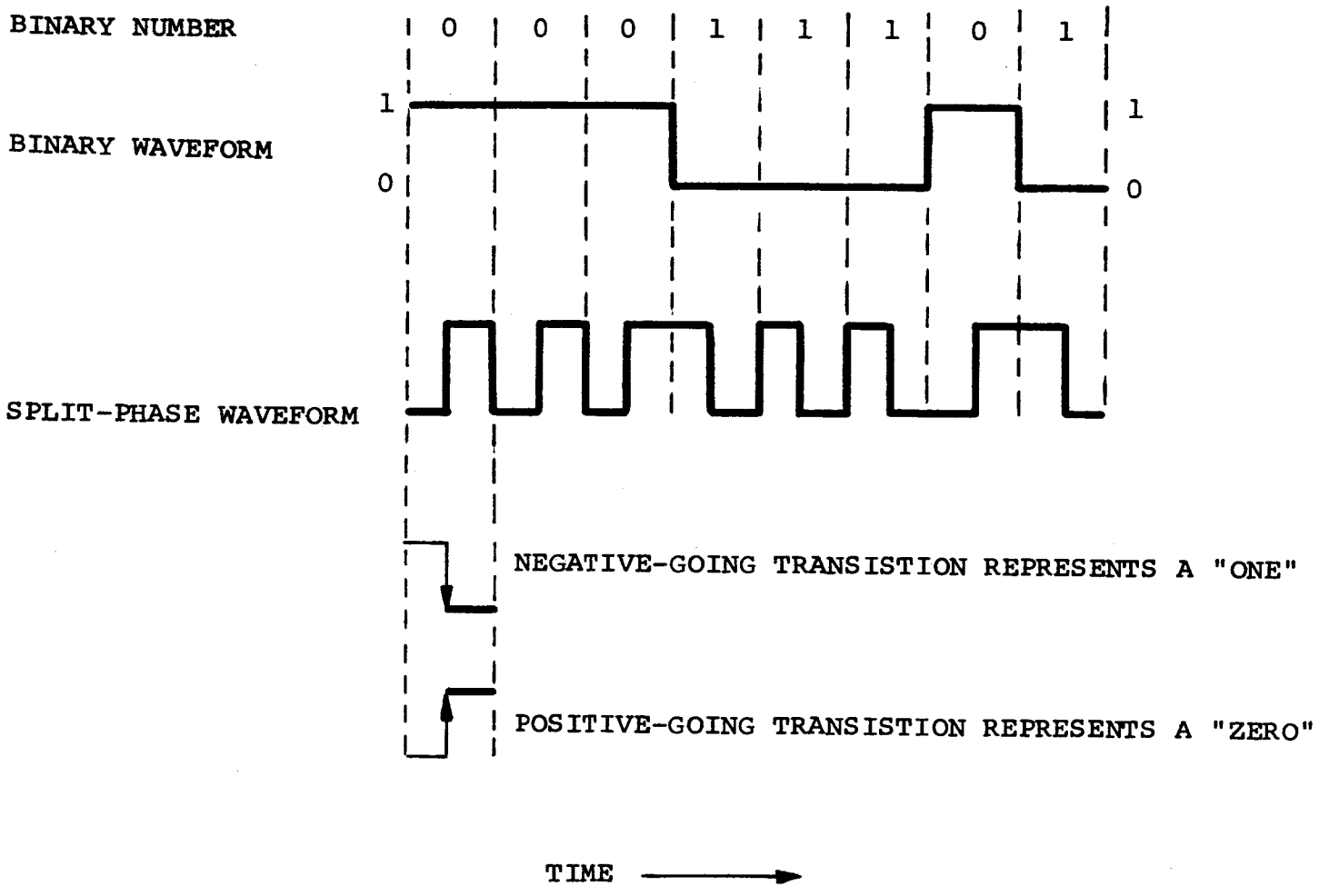


FIGURE 2-1

Split-Phase Waveform

g. DC/DC Converter No. 2

The second half of the two power supply boards contains the input filter network, voltage regulator, secondary level output filters, and the telemetry point circuits.

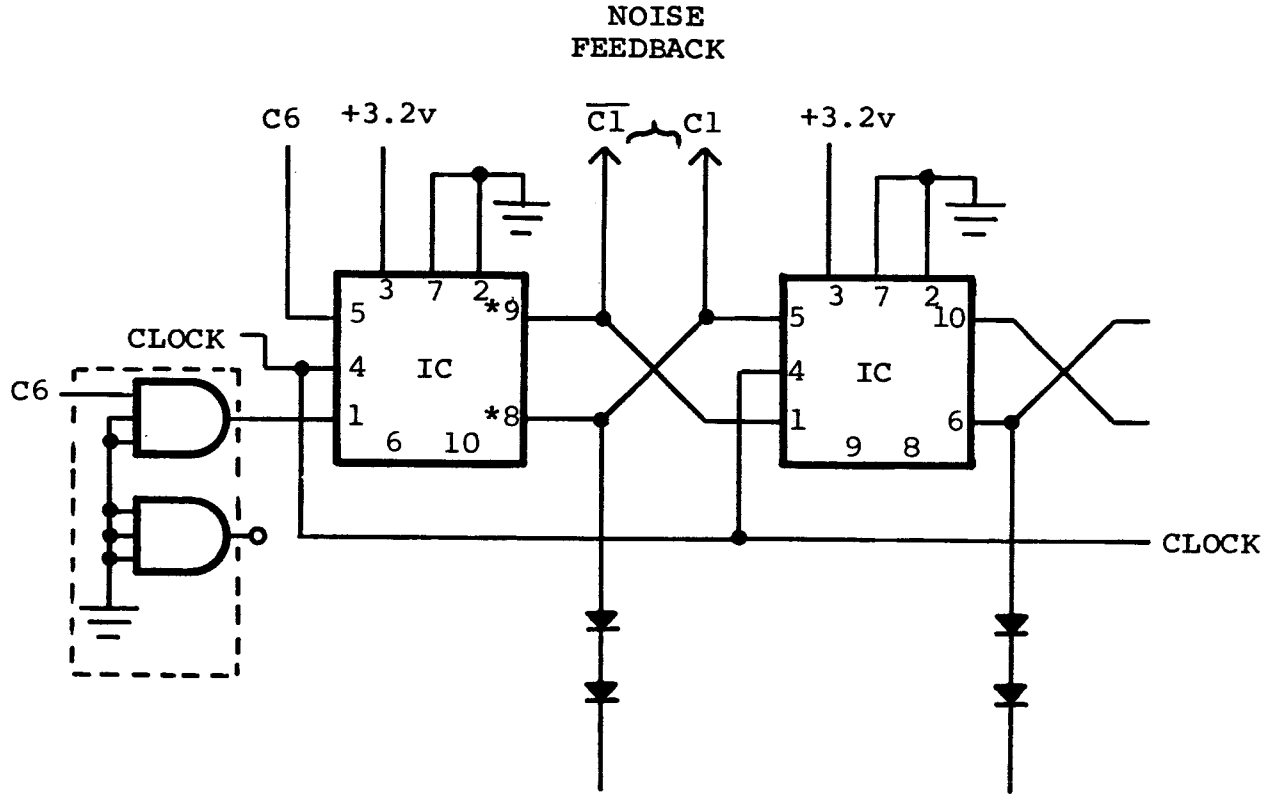
Test equipment to test the PCB's on an individual basis was designed and fabricated. To perform as complete a test as possible on each PCB, functional test specifications were generated for each PCB with the exception of the two power supply boards. These two boards are tested as a unit; therefore, one functional test specification covers both boards.

While performing the initial functional test on the PCB's, several problems were uncovered. The necessary action to solve these problems was initiated and the solutions have been implemented. The malfunctions spoken of here are the types which required printed circuit board modifications and drawing changes. Other discrepancies which have been found are of such a minor nature that they will not be discussed. These discrepancies involved wrong value components, failed parts, term exits on a pin other than noted on the schematic, etc. The intent here is to review each PCB type and comment on it. The electrical schematics and assembly drawings for all PCB's are found in Appendix A.

2.1.1 ANALOG INPUT - 25-KC GENERATOR BOARD

Of the seven PCB's in the MRIR Telemetry Unit, the Analog Input board presented the most problems. The major problem was that noise feedback on the output of the first stage of the commutation ring counter was sufficient to SET the second stage 300 microseconds after it was RESET. The RESET should have been for a time duration of 4.8 milliseconds. The circuit showing the situation when the faulty operation occurred is shown in Figure 2-2. The solution to this problem for the engineering model is shown in Figure 2-3. The gate which was contained on the board, but unused, provided the isolation from the noise feedback on the "zero" side output, while the collector provided isolation on the "one" side output. The use of both the collector output and the emitter-follower output on the "one" output side is ordinarily not a good practice because base drive for the emitter-follower output is reduced. However, in this instance, the emitter-follower fan-out load is only eight. Its maximum fanout is fifteen. Since the emitter follower is driving half its capacity, the simultaneous use of the flip-flop collector output does not divert enough base drive to hamper the emitter-follower operation.

The second problem area on the Analog Input board was the transformer isolation input filter network for the 200-kc clock signal. This network as shown in Figure 2-4 provided too much attenuation on the input clock, and the reduced



*Emitter-Follower Output.

FIGURE 2-2

First Stage Input Commutator
(Pre-Functional Test Design)

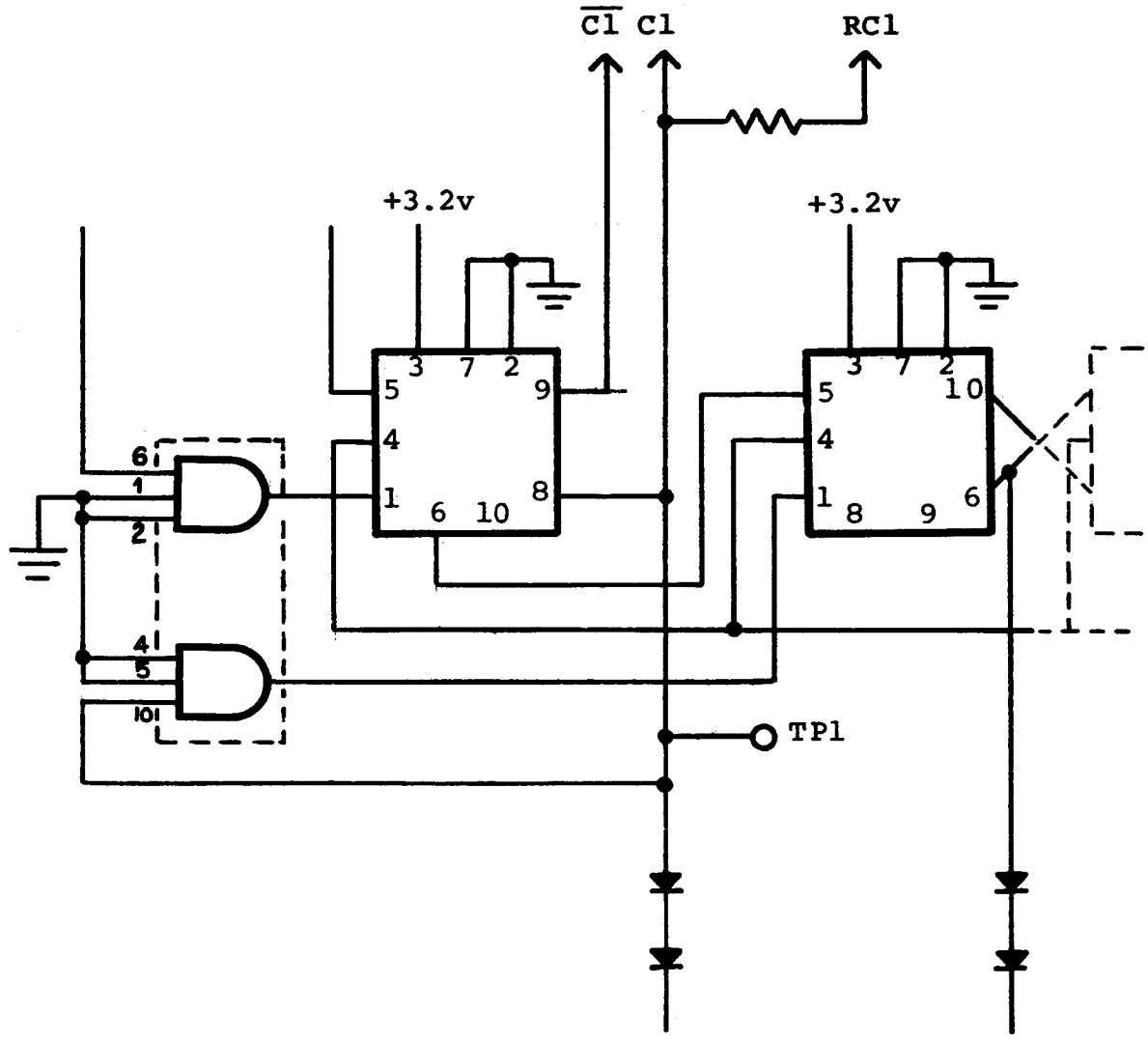


FIGURE 2-3

First Stage Input Commutator
(Engineering Model Fix)

voltage was insufficient to drive the IC device. A review of the NIMBUS "C" MRIR design which had the same clock input requirement showed that this filter network was redesigned to that indicated in Figure 2-5. For the Engineering Model NIMBUS "B" MRIR Telemetry Unit, a compromise was made between the filter networks. The design used on the present MRIR engineering model is shown in Figure 2-6. However, for the subsequent prototype and flight model MRIR's, the filter network shown in Figure 2-5 will be included on the board.

2.1.2 ANALOG/DIGITAL CONVERTER BOARD

The A/D board required some rework as a result of its functional test. Because of the accuracies involved, the A/D design is very sensitive. Extraneous noise was sufficient to cause the A/D Converter to operate erroneously To remedy this situation, the board required additional components to eliminate the noise. One source of noise was the VLAD test point output term which is directly coupled through a 4700-ohm resistance to the comparator input circuit. This integrated circuit has a high impedance input and a very high gain. Any noise pickup on this line was coupled to the comparator input and amplified. To eliminate this action, the 4700-ohm resistor was replaced with a 100-picofarad capacitor tied to signal ground. The VLAD test point term has been eliminated and the noise is now filtered to ground.

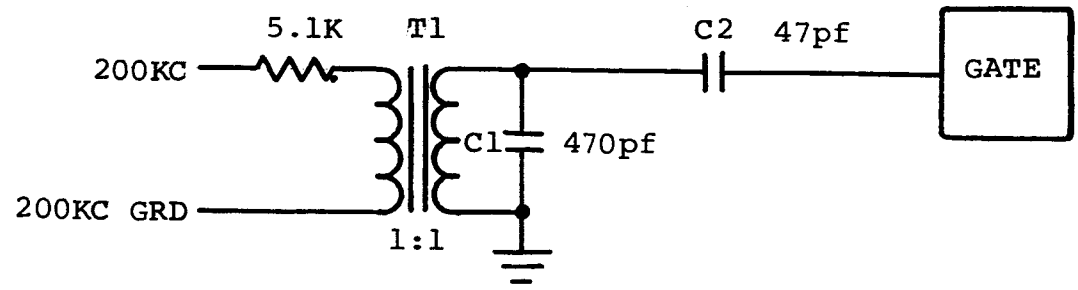
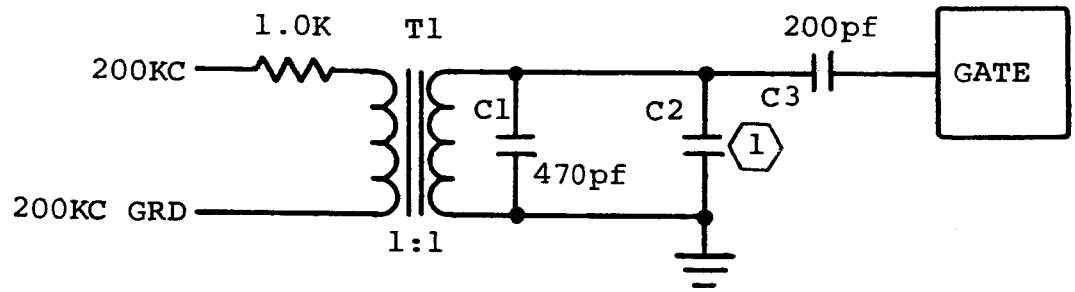


FIGURE 2-4

200KC Input Filter Pre-Functional Test Design



(1) Select

FIGURE 2-5

200KC Input Filter Prototype - Flight Model Design

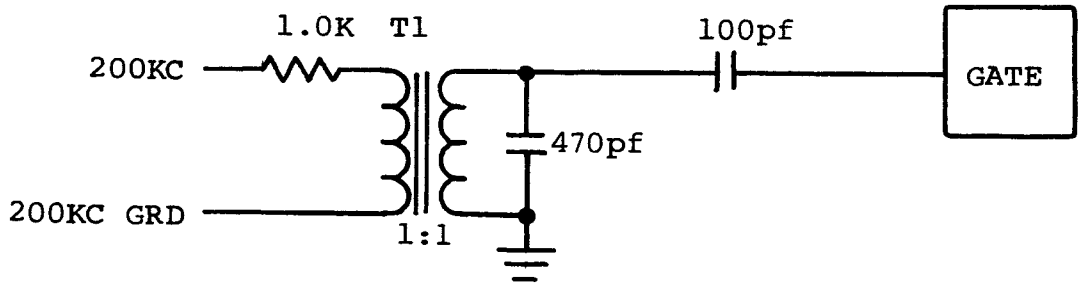


FIGURE 2-6

200KC Input Filter Engineering Model Design

The comparator amplifier required a frequency compensation capacitor between IC pins one and eight. When the A/D board was laid out, no provisions were provided for this compensation. Previous to the layout design, breadboard tests on this IC showed that no frequency compensation was required; however, when the board was fabricated and tested, the operational amplifier broke into a 1-megacycle oscillation when the null point between the actual data input and the ladder network output were approximately equal. A 10-picofarad capacitor was inserted between pins one and eight on the IC comparator amplifier to prevent this oscillation at the null point.

2.1.3 ANALOG/DIGITAL DATA CONTROL

The A/D Data Control logic board did not have any problems associated with it during the board test and the subsystem functional test. Prior to having the board fabricated, a logic error was found on the Frame Sync Inhibit logic. The logic was corrected, the artwork was updated, and the board was fabricated correctly. Figure 2-7 shows the logical representation for the correct mechanization. This mechanization will change the LSB of the data word to a "one" if the data word appears exactly as the Frame Sync word (10111000).

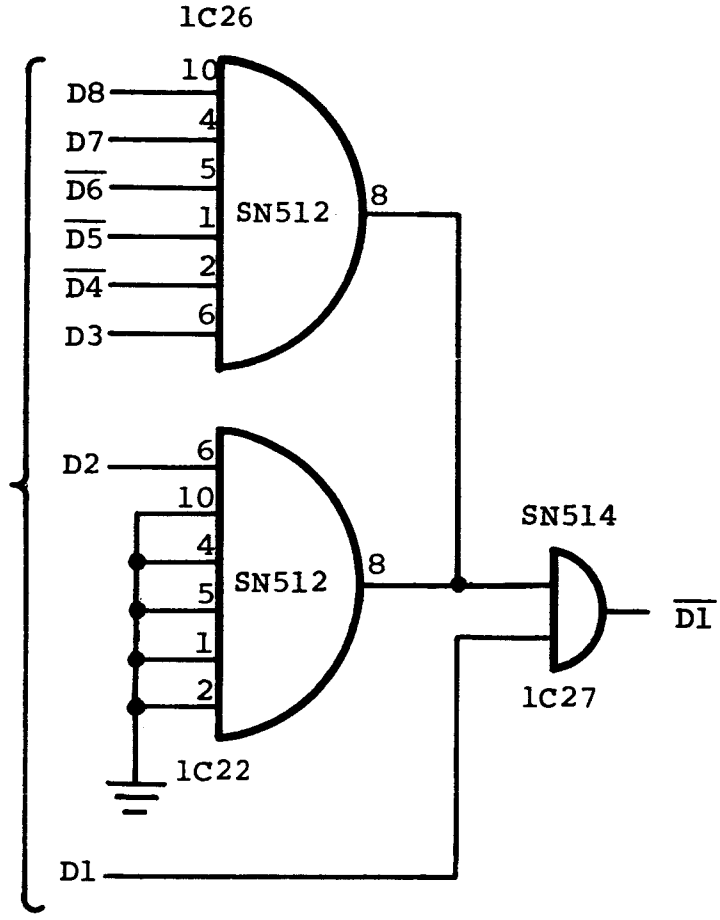


FIGURE 2-7

Frame Sync Inhibit Logic

2.1.4 ENCODE-TIMING GENERATOR

The Encode-Timing Generator board did not require any changes.

2.1.5 FRAME SYNC AND DATA OUTPUT

The Frame Sync and Data Output boards did not require any changes.

2.1.6 DC/DC CONVERTER NOS. 1 AND 2

The two boards which provide the secondary voltage levels did not require any changes.

2.2 GROUNDING SCHEME AND VOLTAGE DISTRIBUTION

Figure 2-8 shows a signal flow diagram which contains the grounding scheme and voltage distribution. The grounding scheme in the MRIR was designed to avoid any ground loops. The power ground and signal grounds are in reality the same ground, but a difference is shown between the two. The power ground pertains to the DC/DC Converter boards, while the signal ground pertains to the other printed circuit boards. Chassis ground and telemetry ground are not internally tied to any point within the engineering model.

However, the telemetry points on the flight models will have the temperature telemetry point referenced to telemetry ground. The secondary power distribution is straightforward and presented no problems. The voltage distribution can be determined on the pin chart contained in Appendix D.

2.3 TELEMETRY POINTS

There are only three telemetry points contained within the Engineering Model MRIR Telemetry Unit. The points are used to monitor that the primary power relay has switched on command, that the minus 12 volt secondary level is maintaining regulation, and what the internal temperature is at the hottest point. A temperature sensitive component (Sensistor) is used to monitor the temperature. The output of the Sensistor as a function of voltage and temperature is shown in Figure 2-9. This curve can be used for calibration purposes. Appendix B gives the electrical information on the other two telemetry point outputs.

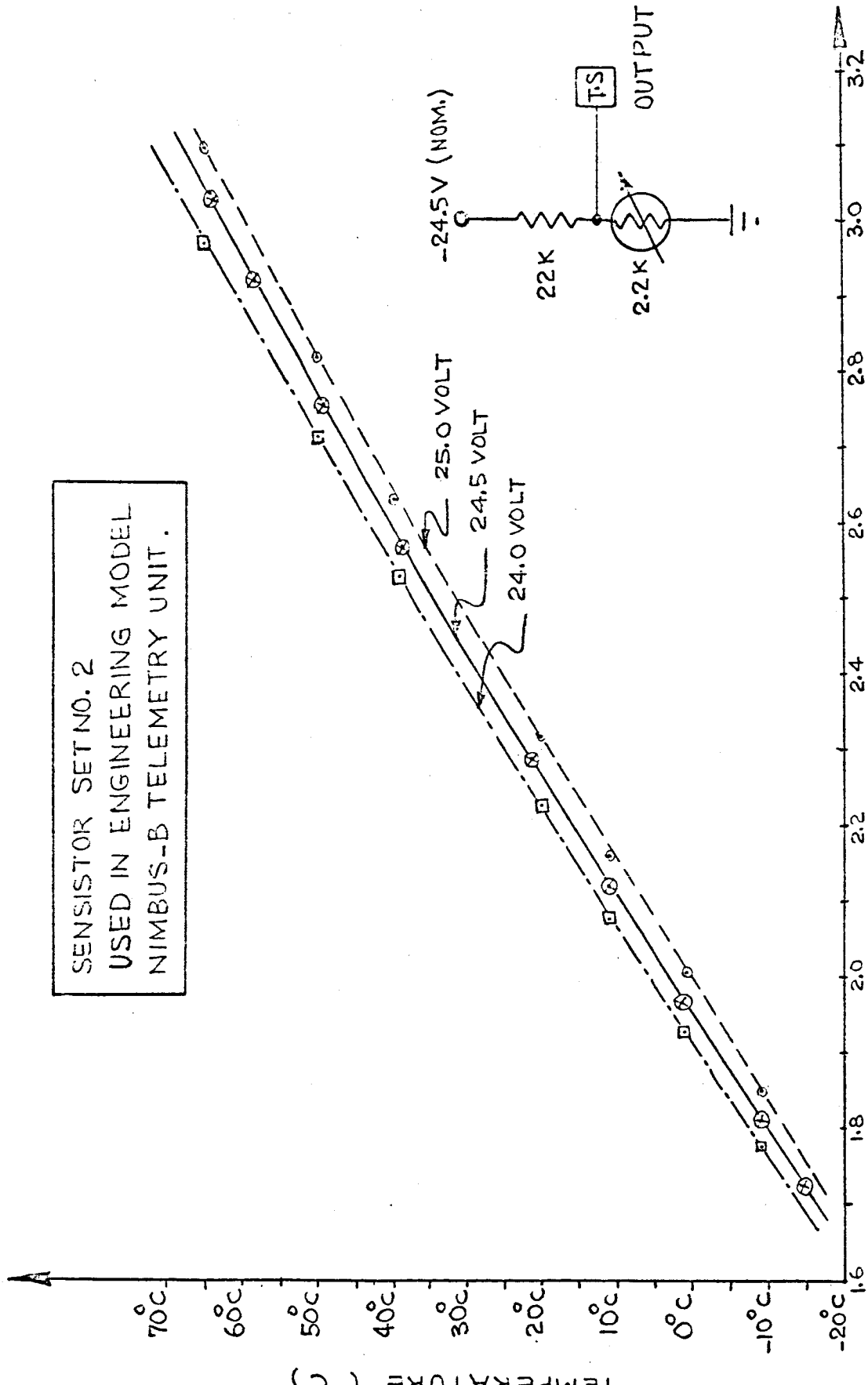


FIGURE 2-9
TEMPERATURE TELEMETRY POINT

2.4 ELECTRICAL PRECAUTIONARY MEASURES

The use of MOS-FET devices has necessitated that extreme care be used in their handling. The devices can be easily damaged by static electricity or high positive voltage spikes. CalComp used precautionary measures during the board assembly as well as during functional test of the printed circuit board, and testing at the completed system level.

During the PCB assembly, the leads of the MOS devices were shorted together before, during, and after the assembly. A special 44-pin shorting plug was wired and attached to the board to tie all the input leads of the MOS devices to signal ground on that assembled module. At the system level, the analog inputs were routed to the J4 Bench Test connector so that a shorting plug (37-pin) provided protection when the MRIR telemetry was not connected. The procedure for system integration or connecting to the BTE is to install all cables to the other four connectors before removing the shorting plug to install the last cable, J4. The reverse procedure is used for cable removal.

2.5 ELECTRONIC DESIGN RECOMMENDATIONS

a. On the Encode-Timing Generator board, a fix was made to isolate the emitter-follower outputs from the outputs going to the next stage of the

commutating ring counter. Instead of simultaneously using the collector output and emitter-follower output on the C1 flip-flop, it is recommended that a gate be added to eliminate the use of the collector output. The mechanization will then be as shown in Figure 2-10.

b. During the course of performing the functional test at the board level and the completed system level, three failed MOS transistors have been encountered. The cause and nature of their failure cannot be explained because other areas of the board or system were under investigation and not the MOS devices themselves. When the attention was turned to the MOS transistors, the failures were detected. The task of removing a multilead TO-5 device from the PCB is a very tedious job and in most cases pads are lifted. In addition, there is the risk of causing a failure to the new device being installed. The MOS-FET's used in the MRIR Telemetry Unit contain two devices within the same TO-5 can. The failure of any one MOS device within the package requires that the package be replaced. The waste here is that one MOS device within the removed package is still good but cannot be used elsewhere. Since these MOS devices can be easily damaged in handling, it is recommended that one MOS device per package per analog input channel be used or

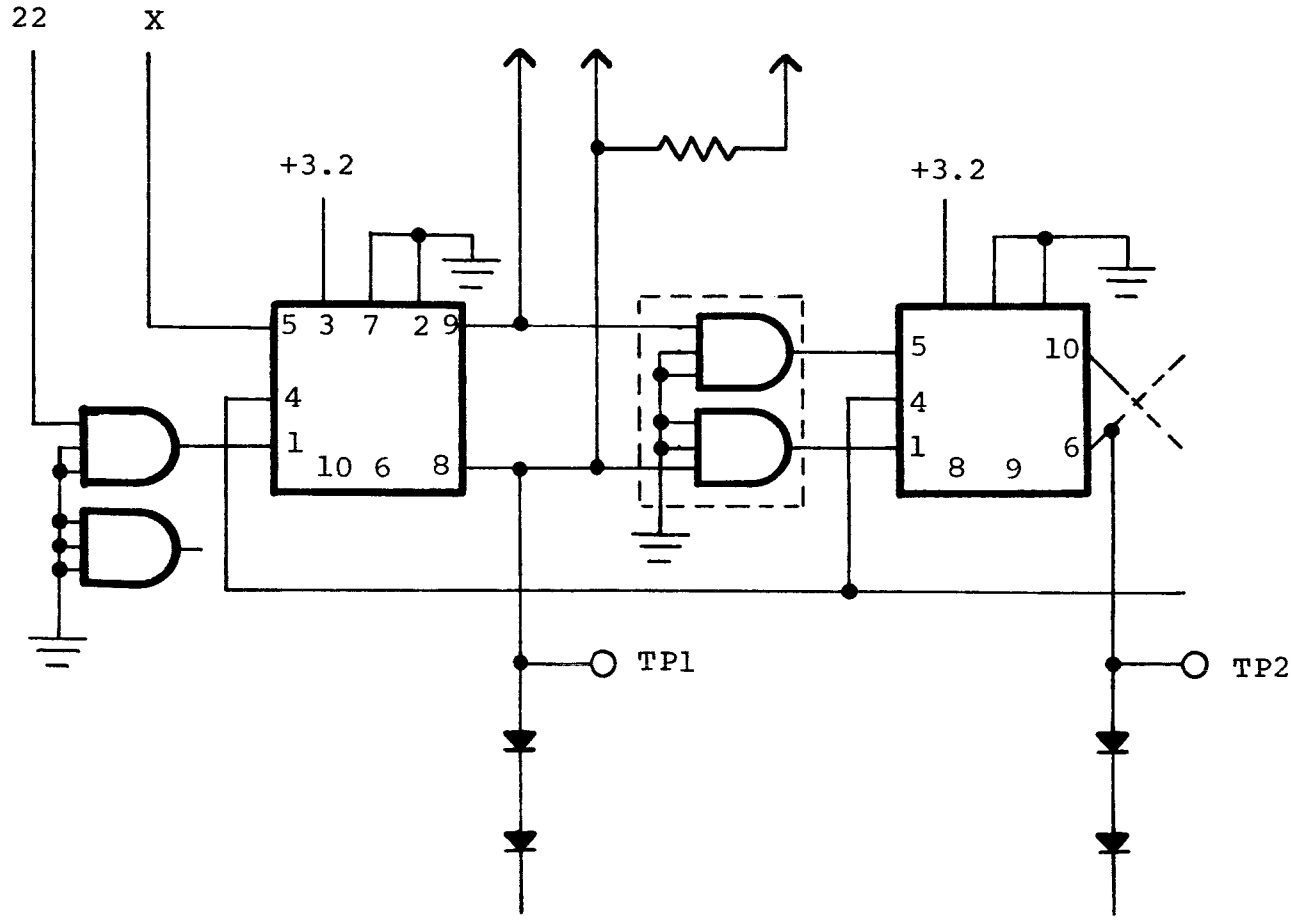
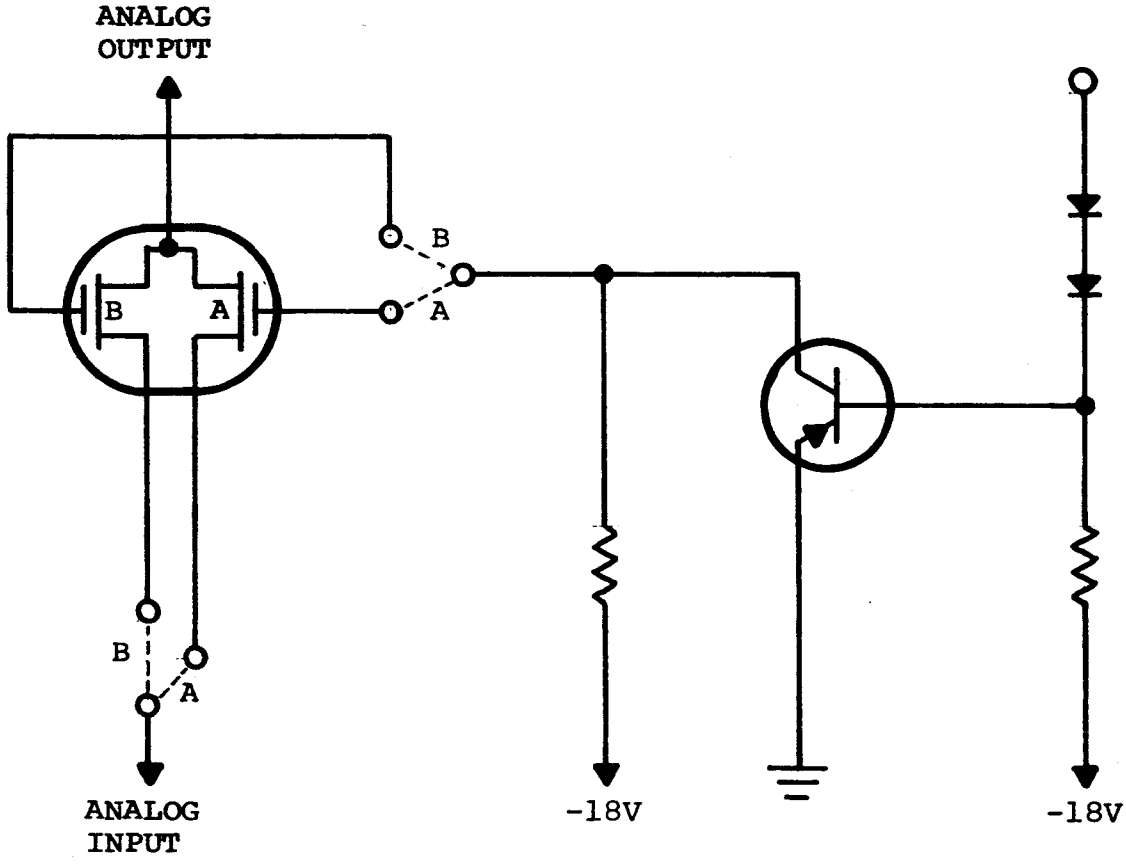


FIGURE 2-10

First Stage Input Commutator
(Prototype - Flight Model Design Recommendation)

that the present two MOS devices per package be used except that the two devices be allocated for one channel only. For the latter recommendation, the five analog input channels would each have two MOS transistors (one package) each. The interconnection on the PCB could be done so that each channel input could be hardwired to use either of the two MOS devices available within the package. The mechanization for one channel input is shown in Figure 2-11. In the present layout, three MOS packages are used, but only five of the six available MOS-FET devices are wired into the circuit. The sixth is left hanging. The proposed scheme requires that only two additional TO-5 packages be added. This recommendation provides economy, saves repair time, and does not subject the PCB to damage which can be caused during repair.



Dotted lines represent shorting wires.

Wire B dotted lines for B MOS-FET.

Wire A dotted lines for A MOS-FET.

NOTE: Only one MOS-FET circuit is wired in at any one time.

FIGURE 2-11

Two MOS-FET Per Analog Input Channel

SECTION 3

MECHANICAL DESIGN

3.1 ENGINEERING MODEL MRIR TELEMETRY UNIT

3.1.1 PACKAGE LAYOUT

The layout of the Engineering Model MRIR Telemetry Unit was changed from the layout initially presented in the design study report to the layout shown in Figure 3-1. The Analog Input - 25-kc Generator board was placed as close as possible to the input/output connectors to keep the analog input lines short. Shields were placed between the analog input board and the input/output connectors to protect against crosstalk. The shield between the DC/DC Converter No. 1 board and the remaining logic modules was to isolate the logic modules from the flux oscillator circuit. The mechanical drawings containing the actual design of the Engineering Model MRIR Telemetry Unit are available in Appendix C.

No mechanical design problems were encountered when the engineering model MRIR was assembled. The machined magnesium parts were finished with the DOW 17 protective coating. All parts fit without modifications. The

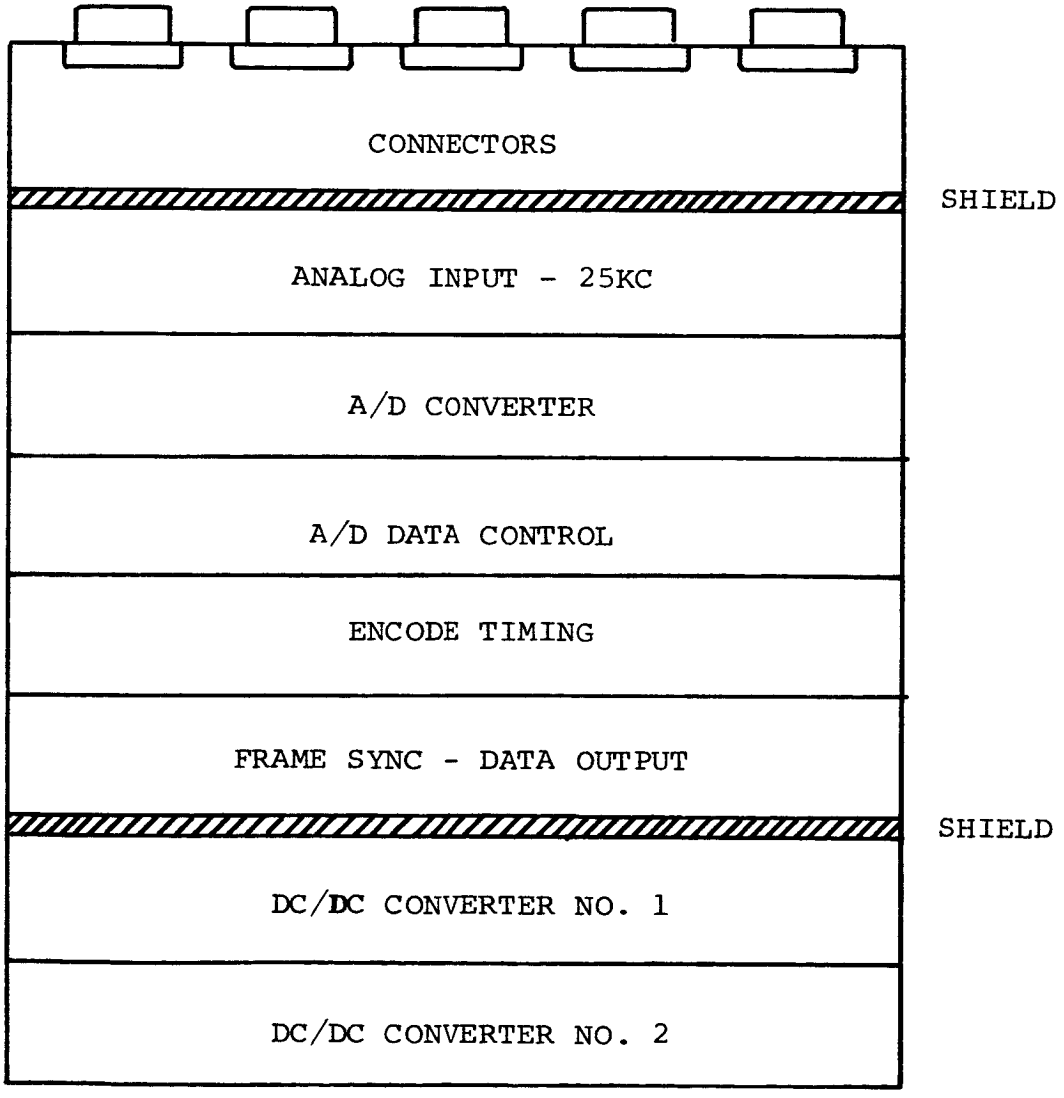


FIGURE 3-1

Printed Circuit Board Allocation

mechanical design drawings pertaining to the chassis parts are complete. The final package size was 2 over 0 or 6 x 4 x 6.5 inches. The housing contained five input/output connectors which are labeled J1 through J5, and the type and function of each connector is indicated in Table 3-1. Each connector is different to prevent mismatching between cables and connectors.

Internal to the housing are seven 44-pin printed circuit board (PCB) connectors which are keyed to match a particular PCB. The PCB's contain slots corresponding to the keys.

3.1.2 PHYSICAL PARAMETERS

3.1.2.1 Layout

The PCB layout of the Engineering Model MRIR Telemetry Unit is shown in Figure 3-1.

3.1.2.2 Weight

The completed engineering model MRIR weighed 4.3 pounds (unpotted). This weight included the shorting plug on connector J4.

3.1.2.3 Power Dissipation

The measured power dissipation of the engineering model

TABLE 3-1

Input/Output Connectors

Connector	Number of Pins	Signals
J1	15-pin Plug	Power Input and Commands
J2	9-pin Socket	Output Signals
J3	15-pin Socket	Input Signals
J4	37-pin Socket	Telemetry and Bench Test Equipment Test Point
J5	9-pin Plug	Input Clock Signals

MRIR was 1.7 watts at minus 10°C. This figure represents the maximum power dissipation.

3.1.3 CENTER OF GRAVITY

The dimensions of measured center of gravity of the engineering model MRIR are shown in Figure 3-2.

3.1.4 MECHANICAL DESIGN RECOMMENDATIONS

The mechanical design is sufficient as it stands for the engineering model telemetry unit; therefore, prototype and flight models will be mechanically fabricated in the same manner as the engineering model.

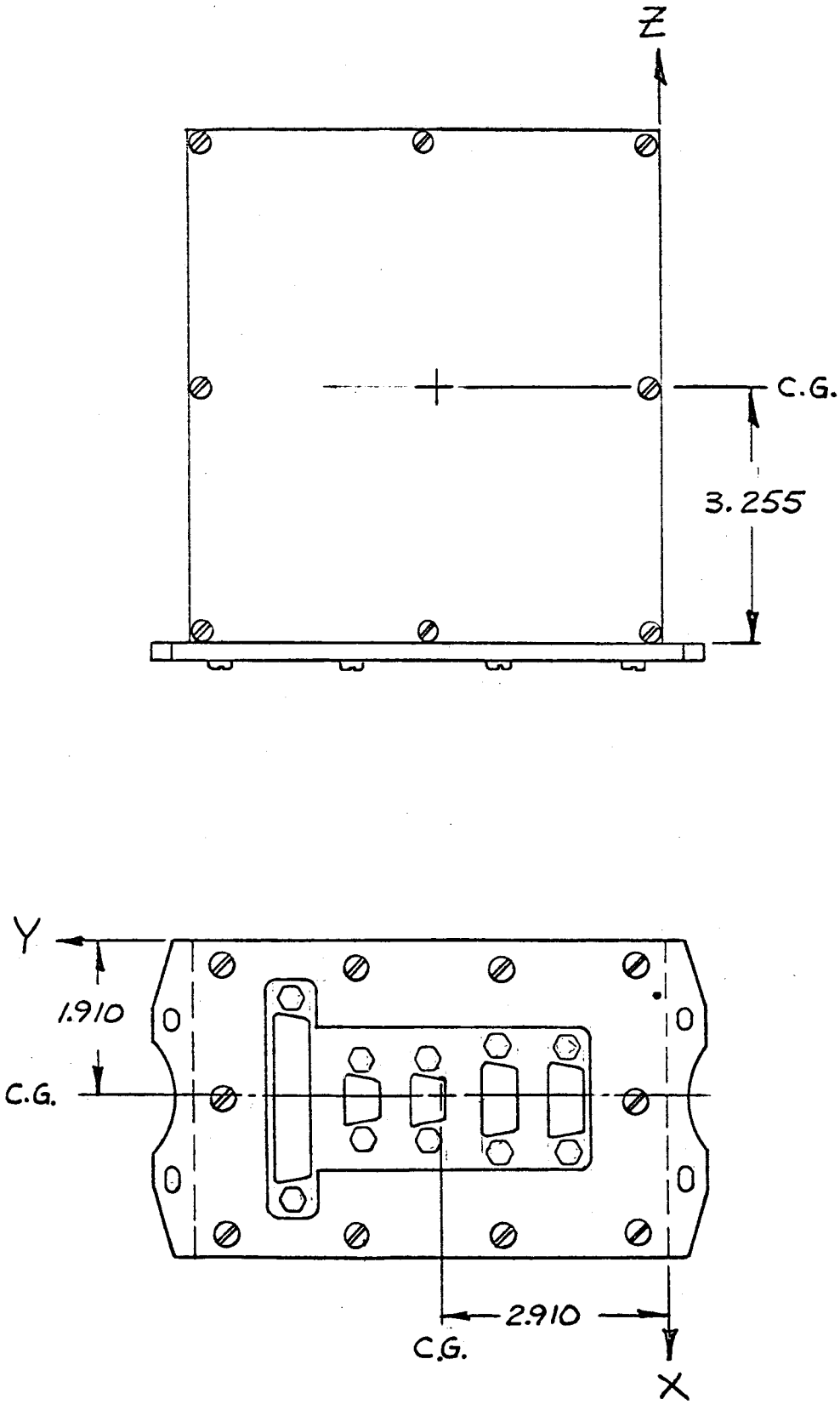


FIGURE 3-2

MRIR Telemetry Unit
Engineering Model Center of Gravity

3.2 BENCH TEST EQUIPMENT

3.2.1 PHYSICAL DESCRIPTION

The MRIR Telemetry Unit Bench Test Equipment is housed in two single bay racks. One rack, called the display console, houses the power supply drawer, test point panel, data display drawer, and a console blower. See Figure 3-3. The other rack, the auxiliary console, houses the remaining commercial test equipment, which includes a Tektronix RM45A oscilloscope, a Non-Linear Systems Model 484A digital voltmeter, and an Exact Electronics Model 250 function generator. In addition to a console blower, the latter bay is equipped with a loose equipment drawer and a writing surface. This unit is shown in Figure 3-4. A more comprehensive description can be obtained from the Bench Test Equipment Document D0106-004 entitled "Maintenance Manual for MRIR-PCM Bench Test Equipment, NIMBUS B," dated 24 March 1966.

Convenience outlets are available at the power supply drawer and the rear of the auxiliary console. Both consoles are designed to be operated from single-phase, 115-vac power. The display console is protected by a 10-ampere circuit breaker in the a-c line, with a 15-ampere breaker protecting the auxiliary console. In addition, the d-c power supplies are protected by a line fuse.

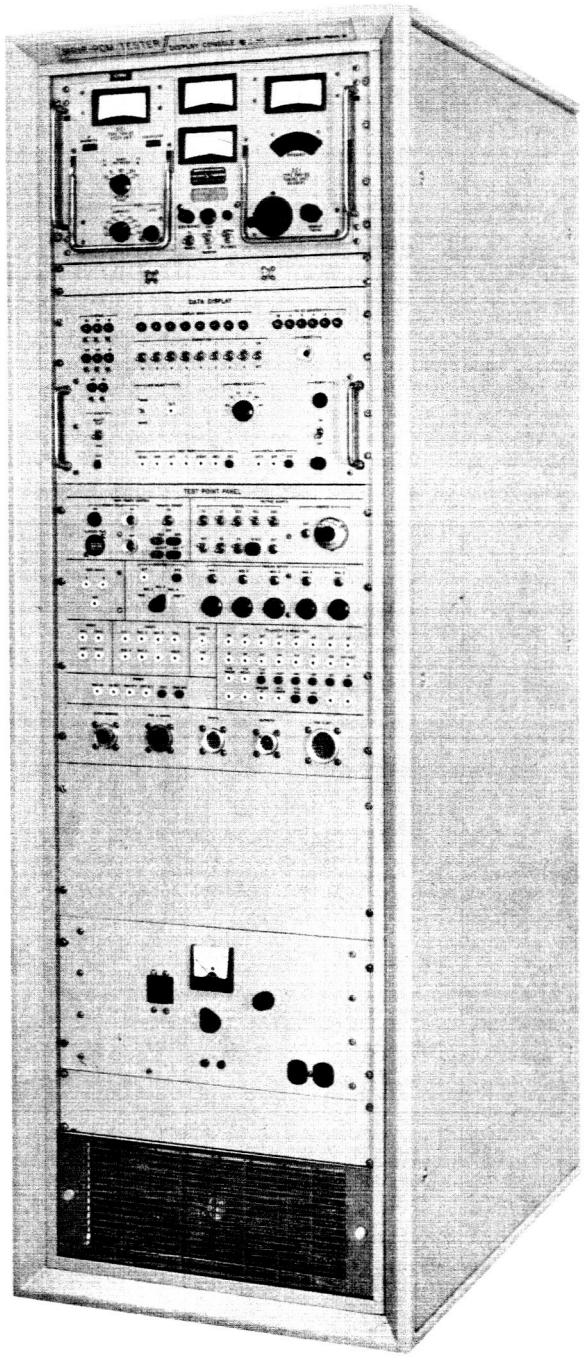


FIGURE 3-3

Display Console

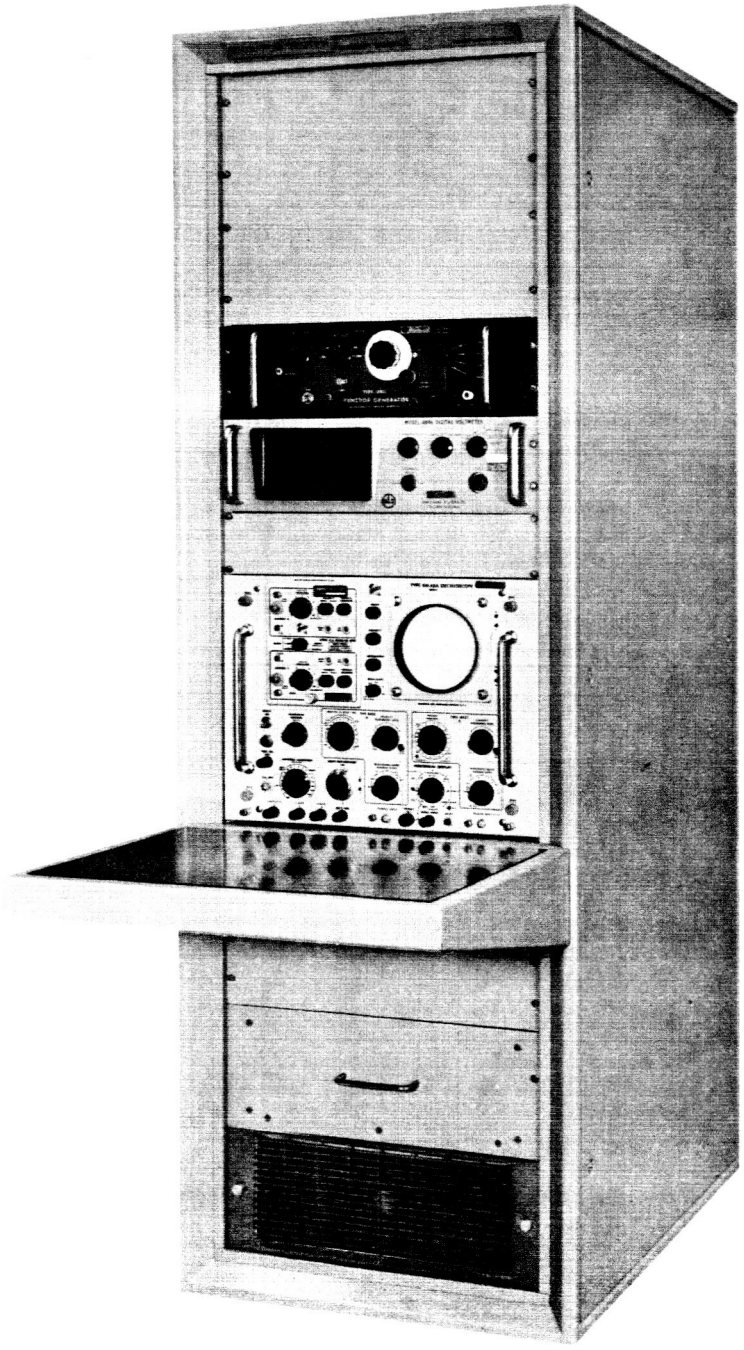


FIGURE 3-4

Auxiliary Console

SECTION 4

SYSTEM TEST AND OPERATION

4.1 SYSTEM TEMPERATURE CYCLE TEST

The engineering model was placed into a temperature controlled oven to test the effects of the unit at +60°C, and at -10°C. The results of each test on a per channel basis are contained in Tables 4-1, 4-2, 4-3, and 4-4. In all cases, the MRIR unit was allowed to temperature soak (no applied power) for approximately forty-five minutes. The internal temperature of the unit was determined by monitoring the Sensistor.

4.2 MRIR TELEMETRY UNIT INTERFACE

The interface list for the Engineering Model MRIR Telemetry Unit is contained in Appendix B. The list provides the terms on each connector pin plus the equivalent voltages and impedances on those pins which originate or terminate on the telemetry unit.

4.3 MRIR TELEMETRY TIMING DIAGRAM

A timing diagram showing the relationship among the logic signals within the MRIR Telemetry Unit is presented in Figure 4-1 on page 4-6.

TABLE 4-1

MRIR Telemetry Unit Power Supply
Temperature Test at +60°C Ambient

Secondary Voltage Levels	Primary Power Input		
	-24.0 ± 0.02v	-24.5 ± 0.02v	-25.0 ± 0.02v
+3.2 $^{+0.23}_{-0.10}$	+3.189	+3.189	+3.189
+6 ± 0.18	+6.128	+6.127	+6.128
-6 ± 0.18	-6.154	-6.154	-6.154
-12 ± 0.36	-12.25	-12.25	-12.25
-18 ± 0.54	-18.42	-18.42	-18.42

TABLE 4-2

MRIR Telemetry Unit Power Supply
Temperature Test at -10°C Ambient

Secondary Voltage Levels	Primary Power Input		
	-23.5 ± 0.02v	-24.5 ± 0.02v	-25.5 ± 0.02v
$+3.2\ ^{+0.23}_{-0.10}$	+3.117	+3.117	+3.118
+6 ± 0.18	+5.907	+5.907	+5.908
-6 ± 0.18	-5.937	-5.938	-5.939
-12 ± 0.36	-11.97	-11.97	-11.97
-18 ± 0.54	-18.05	-18.05	-18.05

TABLE 4-3

MRIR Telemetry Unit Analog/Digital
Conversion at +60°C Ambient Temperature
(Nominal Voltage)

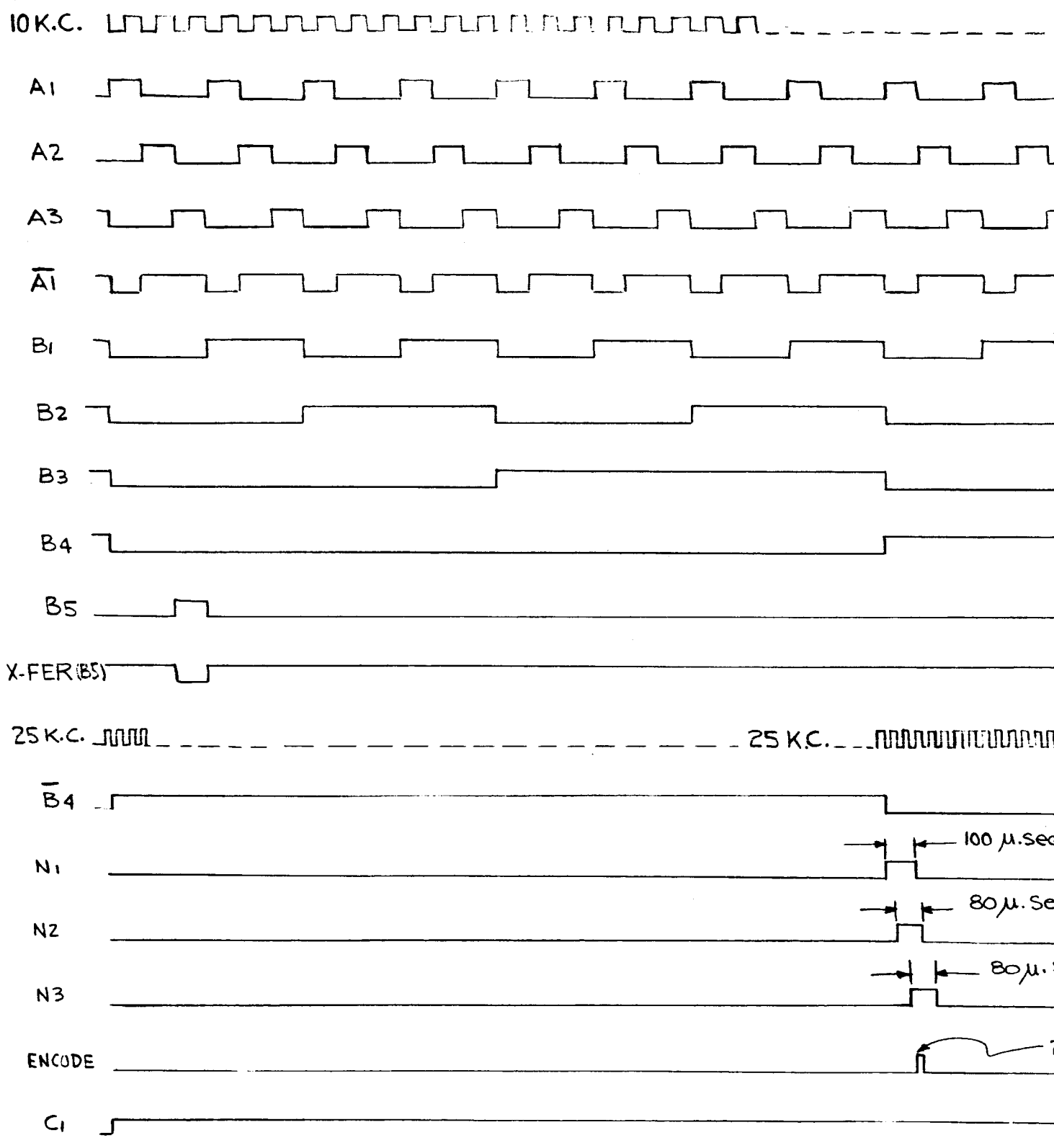
Bit	Channel				
	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5
2^0 (25mv)	-18mv	-19mv	-20mv	-20mv	-20mv
2^1 (50mv)	-45	-45	-45	-45	-45
2^2 (100mv)	-94	-95	-95	-95	-95
2^3 (200mv)	-194	-195	-195	-196	-196
2^4 (400mv)	-396	-396	-396	-396	-396
2^5 (800mv)	-797	-797	-797	-797	-797
2^6 (1600mv)	-1596	-1596	-1596	-1596	-1596
2^7 (3200mv)	-3197	-3197	-3197	-3197	-3197
All Bits 6375mv	-6372	-6372	-6372	-6372	-6372

TABLE 4-4

MRIR Telemetry Unit Analog/Digital
Conversion at -10°C Ambient Temperature
(Nominal Voltage)

Bit		Channel				
		Channel 1	Channel 2	Channel 3	Channel 4	Channel 5
2^0	-25mv	-19mv	-20mv	-20mv	-20mv	-20mv
2^1	-50mv	-44	-45	-45	-45	-45
2^2	-100mv	-94	-95	-95	-95	-95
2^3	-200mv	-194	-196	-196	-196	-196
2^4	-400mv	-396	-396	-396	-396	-396
2^5	-800mv	-796	-796	-796	-796	-796
2^6	-1600mv	-1596	-1596	-1596	-1596	-1596
2^7	-3200mv	-3197	-3197	-3196	-3196	-3196
All Bits	-6375mv	-6372	-6372	-6372	-6372	-6372

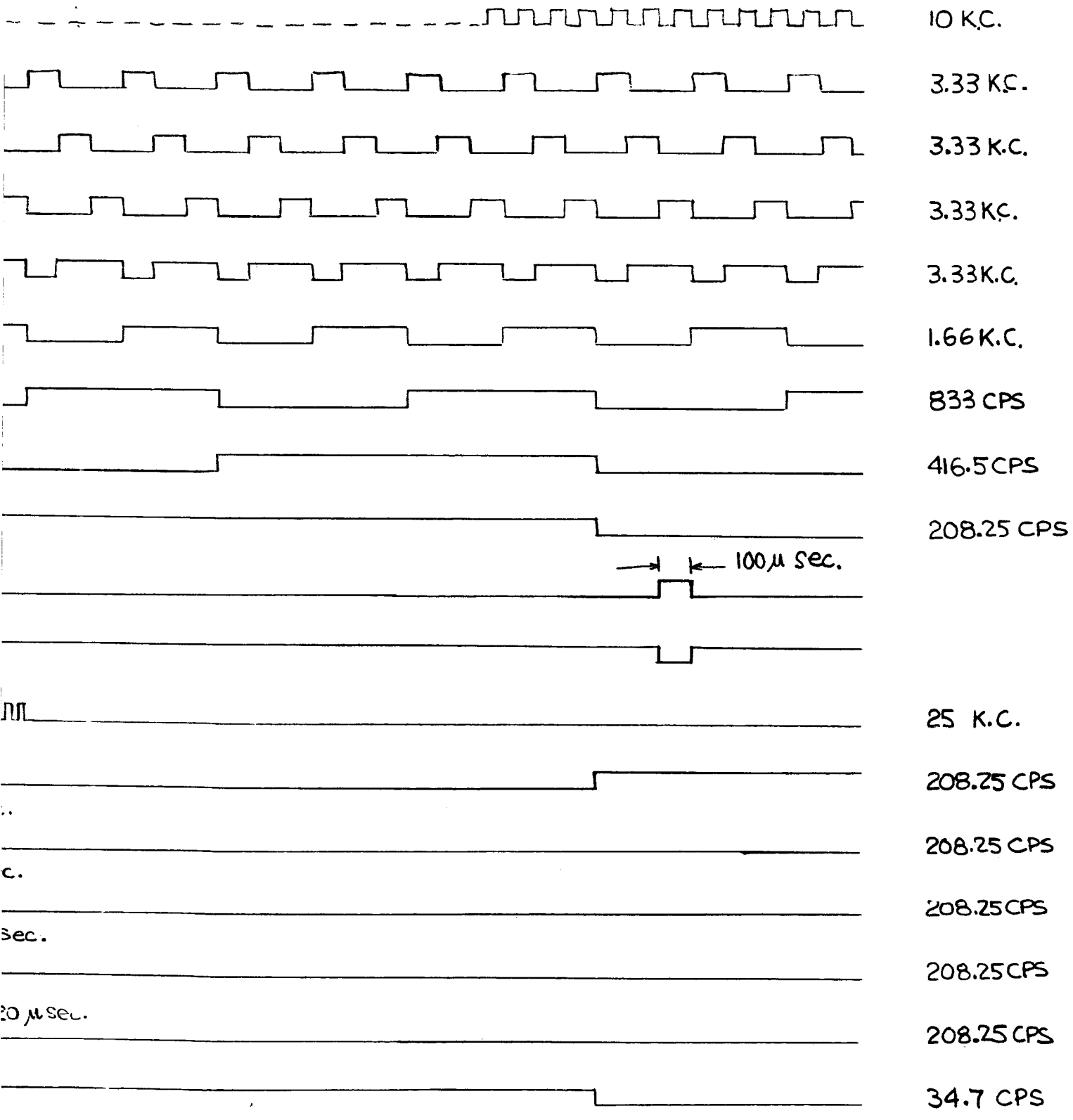
TIMING CHAR



FIGURE

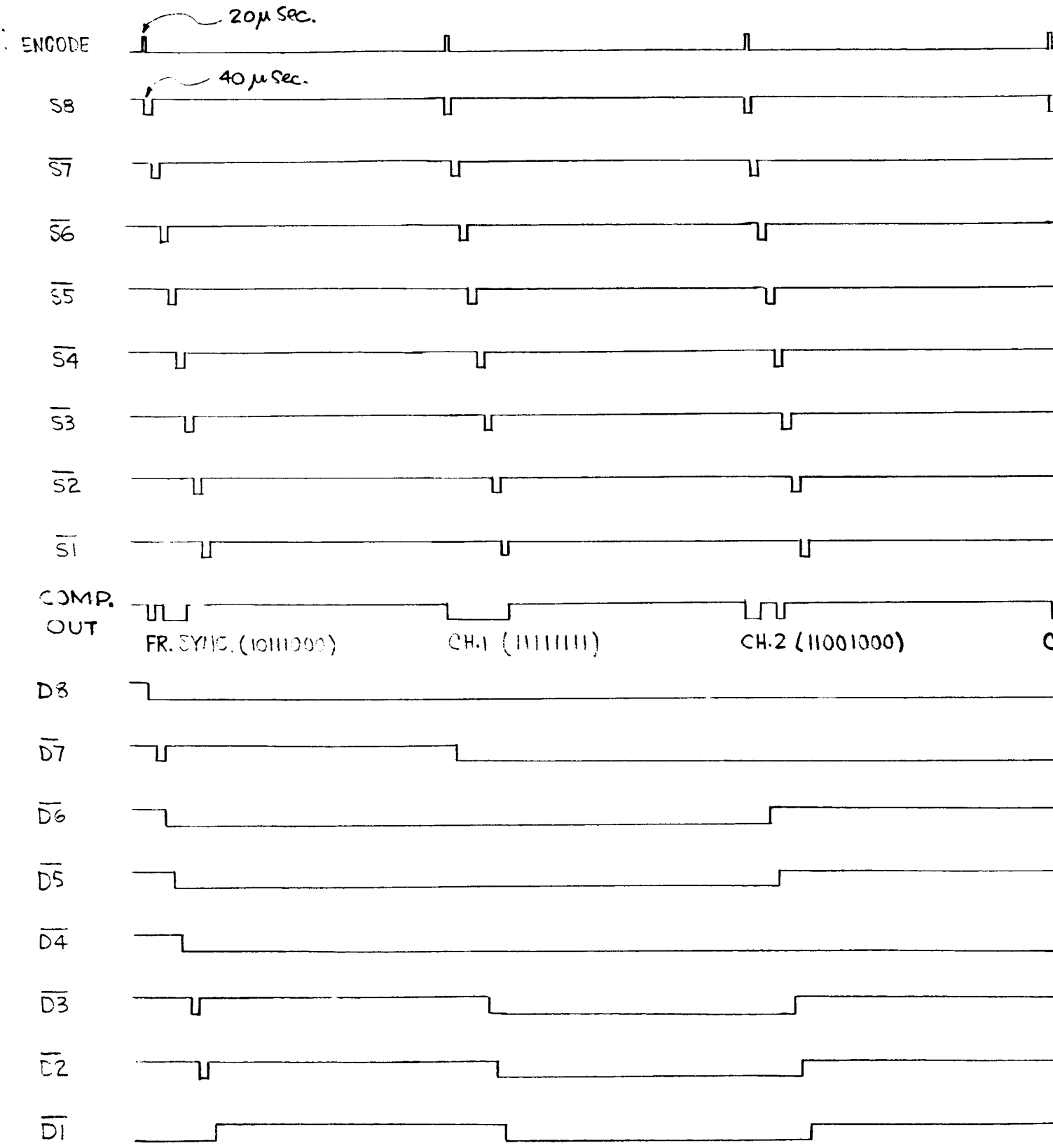
4-6-1

T NIMBUS-B MRIR (TELMETRY UNIT)



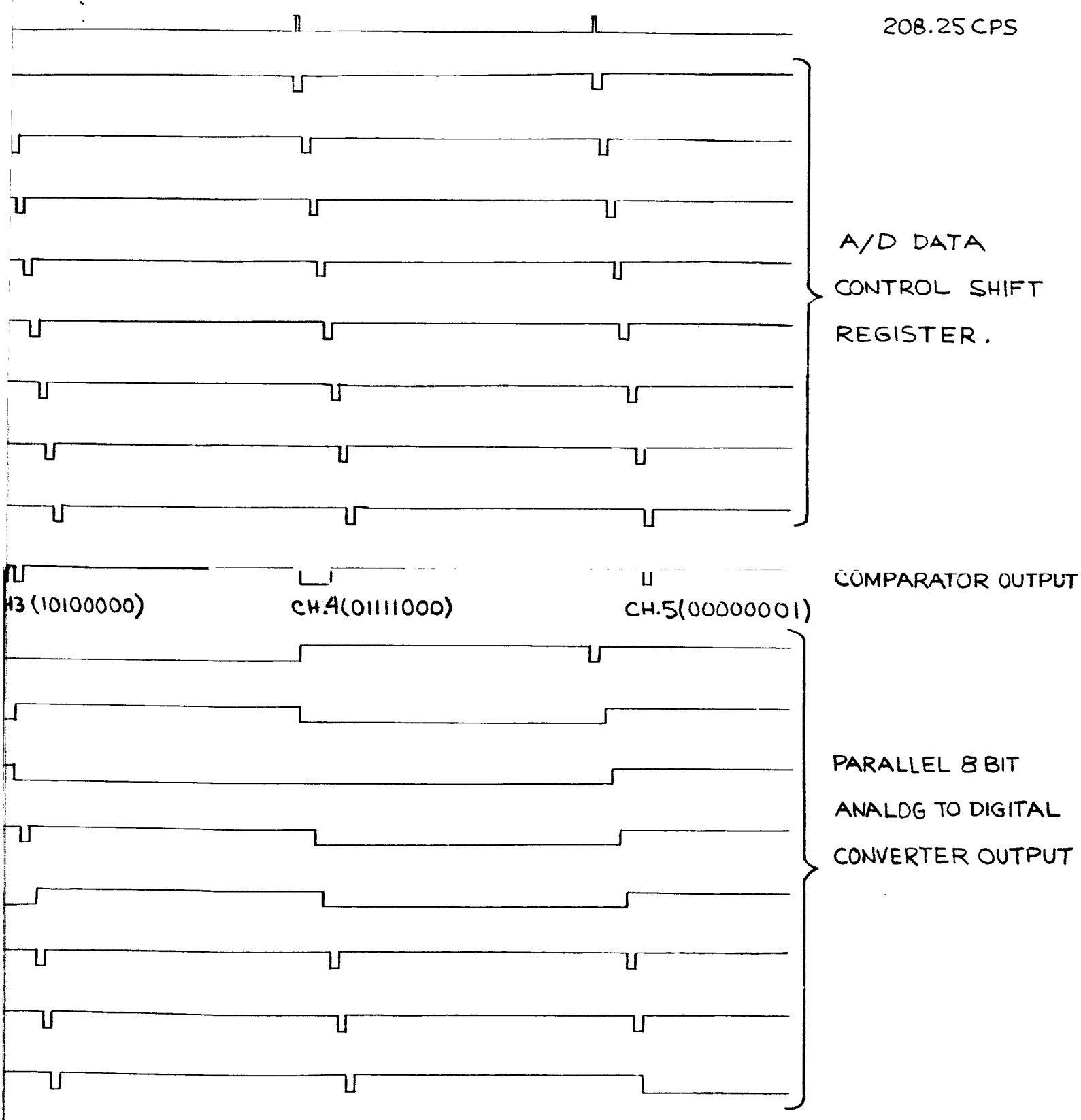
4-1

4-6-2



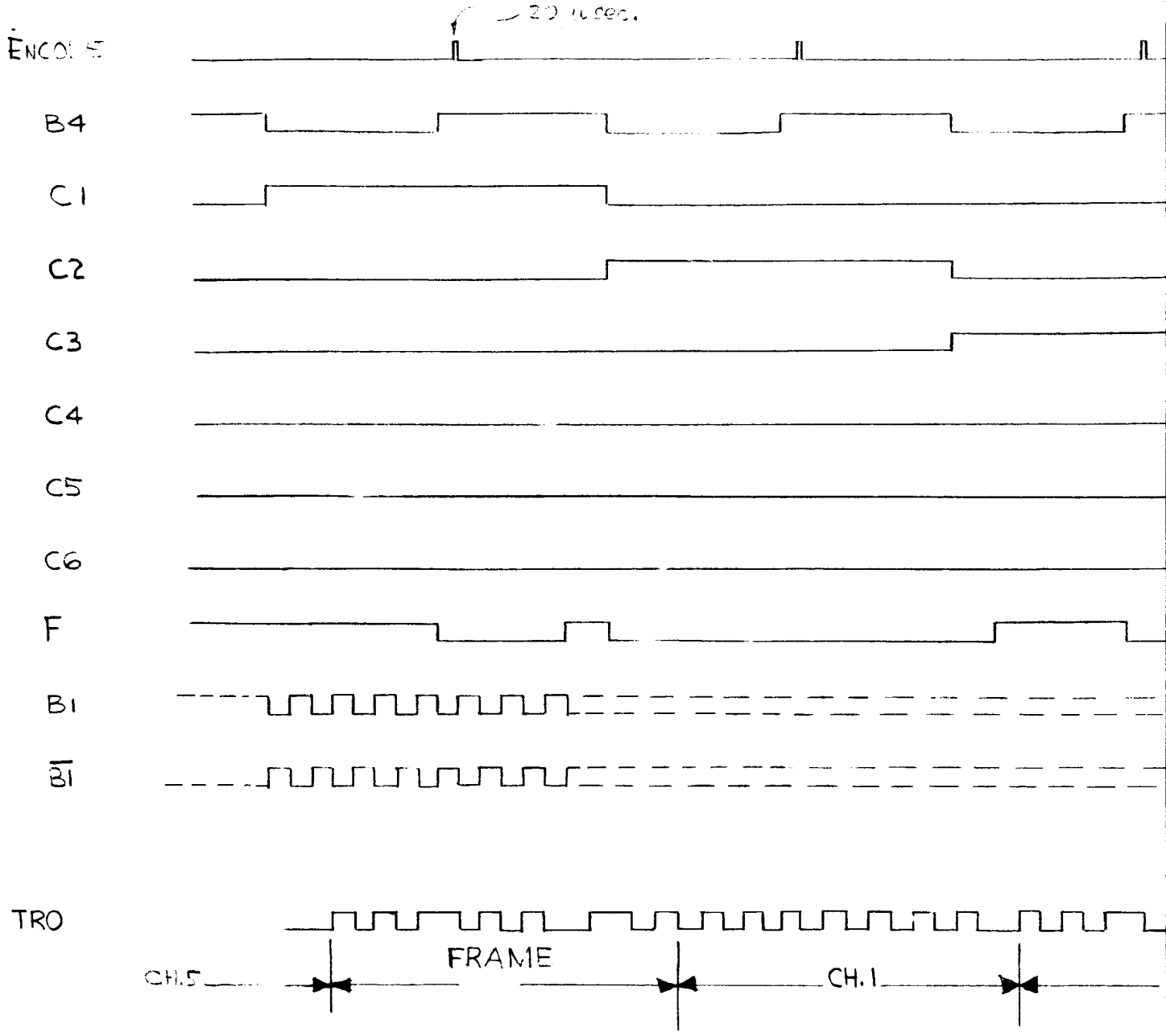
NOTE :- CH1 = 0.575 VOLT , CH2 = 5.0 VOLT , CH

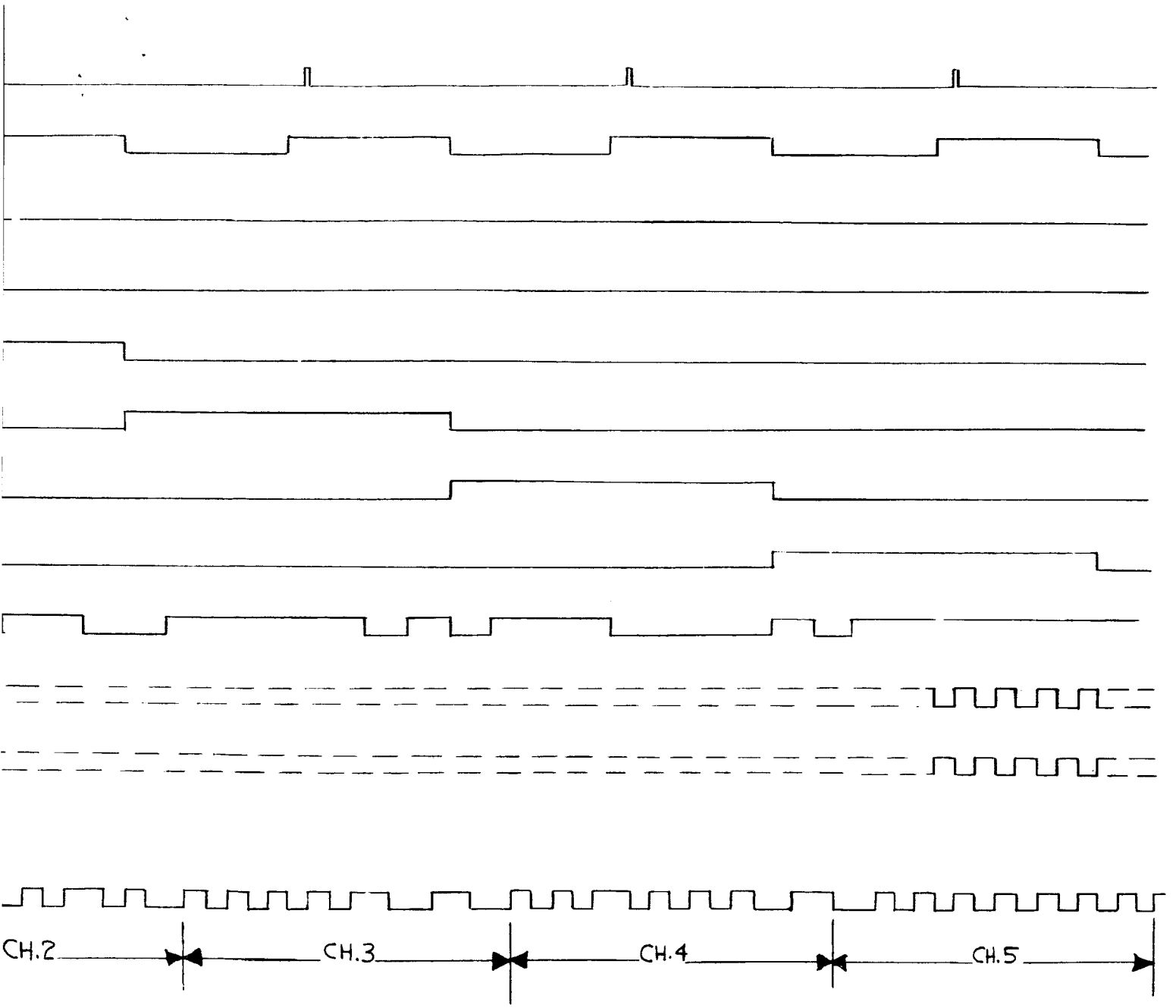
4-7-1



3 = 4.0 VOLT, CH4 = 3.0 VOLT, CH5 = 0.025 VOLT.

4-7-2


20 μsec.
ENCODE
B4
C1
C2
C3
C4
C5
C6
F
B1
$\overline{B1}$
TRO
CH.5
FRAME
CH.1



F = SERIAL DATA OUTPUT

TRO= SPLIT PHASE SERIAL OUTPUT
TO TAPE RECORDER.

4-8-2

4.4 INTERCONNECTION DIAGRAM

Appendix D provides a combination wire list and interconnecting diagram. The JXXX numbers associated with the connector terms indicate where the wire is going.

SECTION 5

NEW TECHNOLOGY

Throughout the performance of the contract NAS5-9699, a continual review of the work performed was conducted by a designated committee, including the Project Manager and the Patent Counsel. The committee met periodically to discuss all effort performed with a view to ascertaining reportable items disclosed in performance of the contract, both by the contractor and all subcontractors.

5.1 RESULTS OF CONTRACTOR'S REVIEW

The following are considered reportable items under the "New Technology" clause:

a. Reportable Item: Analog-to-Digital Converter Circuit.
   Invention Status: Not reasonably patentable.
   Apparent Use: An analog-to-digital converter.
   Description: The analog-to-digital converter for this contract is based almost entirely on the design submitted by NASA to the contractor. The contractor made some component changes

in incorporating some new integrated components which the contractor bought as off-the-shelf items from Fairchild Semiconductor Corporation. The design of the circuit was slightly different due to the requirements of the integrated components. The complete circuit is shown in this report as drawing No. D-10368-502.

b. Reportable Item: Interface Buffer Circuit.
Invention Status: Not reasonably patentable.
Apparent Use: A data output buffer circuit.
Description: The data output buffer circuit for the frame sync and data output is of standard design utilizing integrated circuit components. The circuit is based on the design submitted to the contractor by NASA. The circuit is shown in drawing No. 10354-502.

There were no subcontractors reportable under the "New Technology" clause.

SECTION 6

BIBLIOGRAPHY

The following documents are directly related to the design and development of the Engineering Model MRIR Telemetry Unit.

6.1 TECHNICAL REPORTS AND MANUALS

a. D0201-65/118 - 21 September 1965

A technical proposal for a Medium Resolution IR (MRIR) Experiment Engineering Model Digital Electronics Telemetry Unit for NIMBUS "B."

b. D0301-013 - 31 December 1965

Reliability Assessment and Development Study Report on MRIR-PCM Subsystem.

c. D0106-003 - 10 March 1966

Operator's Manual for MRIR-PCM Digital Subsystem Bench Test Equipment, NIMBUS "B."

d. D0106-004 - 24 March 1966

Maintenance Manual for MRIR-PCM Bench Test Equipment, NIMBUS "B."

e. 20101-01 - 23 November 1965

Engineering Model MRIR Telemetry Unit Telecon Report.

f. 20101-02 - 7 December 1965

Engineering Model MRIR Telemetry Unit Telecon Report.

g. 20101-03 - 9 December 1965

Engineering Model MRIR Telemetry Unit Telecon Report.

h. 20101-04 - 14 December 1965

Engineering Model MRIR Telemetry Unit DC/DC Converter Analysis.

i. 20101-05 - 20 December 1965

Engineering Model MRIR Telemetry Unit Telecon Report.

j. 20101-07 - 5 January 1966

Engineering Model MRIR Telemetry Unit Telecon Report.

k. 20101-08 - 11 January 1966

Engineering Model MRIR Telemetry Unit Telecon Report.

l. 20101-09 - 18 January 1966

Engineering Model MRIR Telemetry Unit Telecon Report.

m. 20101-010 - 19 January 1966

Stresses Caused by Module Clamps.

n. 20101-011 - 4 February 1966

Engineering Model MRIR Telemetry Unit Telecon Report.

o. 20101-014 - 22 March 1966

Engineering Model MRIR Telemetry Unit Telecon Report.

6.2 MONTHLY PROGRESS REPORTS

a. D0513-001 - 14 December 1965

Monthly Progress Report No. 1 for MRIR-PCM Telemetry Unit, 1 November 1965 - 28 November 1965

b. D0513-002 - 11 January 1966

Monthly Progress Report No. 2 for MRIR-PCM Telemetry Unit, 29 November 1965 - 2 January 1966.

c. D0513-003 - 8 February 1966

Monthly Progress Report No. 3 for MRIR-PCM Telemetry Unit, 2 January 1966 - 31 January 1966.

d. D0513-004 - 7 March 1966

Monthly Progress Report No. 4 for MRIR-PCM Telemetry Unit, 1 February 1966 - 28 February 1966.

e. D0513-005 - 14 April 1966

Monthly Progress Report No. 5 for MRIR-PCM Telemetry Unit, 1 March 1966 - 31 March 1966.

6.3 FUNCTIONAL TEST SPECIFICATIONS

a. A0205-101 - 29 April 1966

Functional Test Specification for Analog Input and 25-KC Generator.

b. A0205-102 - 5 May 1966

Functional Test Specification for Analog-to-Digital Converter.

c. A0205-103 - 29 April 1966

Functional Test Specification for Analog-to-Digital Data Control.

d. A0205-104 - 29 April 1966

Functional Test Specification for Encode-Timing Generator.

e. A0205-105 - 2 May 1966

Functional Test Specification for Frame Sync and Data Output.

f. A0205-106 - 10 May 1966

Functional Test Specification for DC-to-DC Converter No. 1 and No. 2.

g. A0201-019 - 10 March 1966

Functional Test Specification for the MRIR-PCM Digital Subsystem, NIMBUS "B."

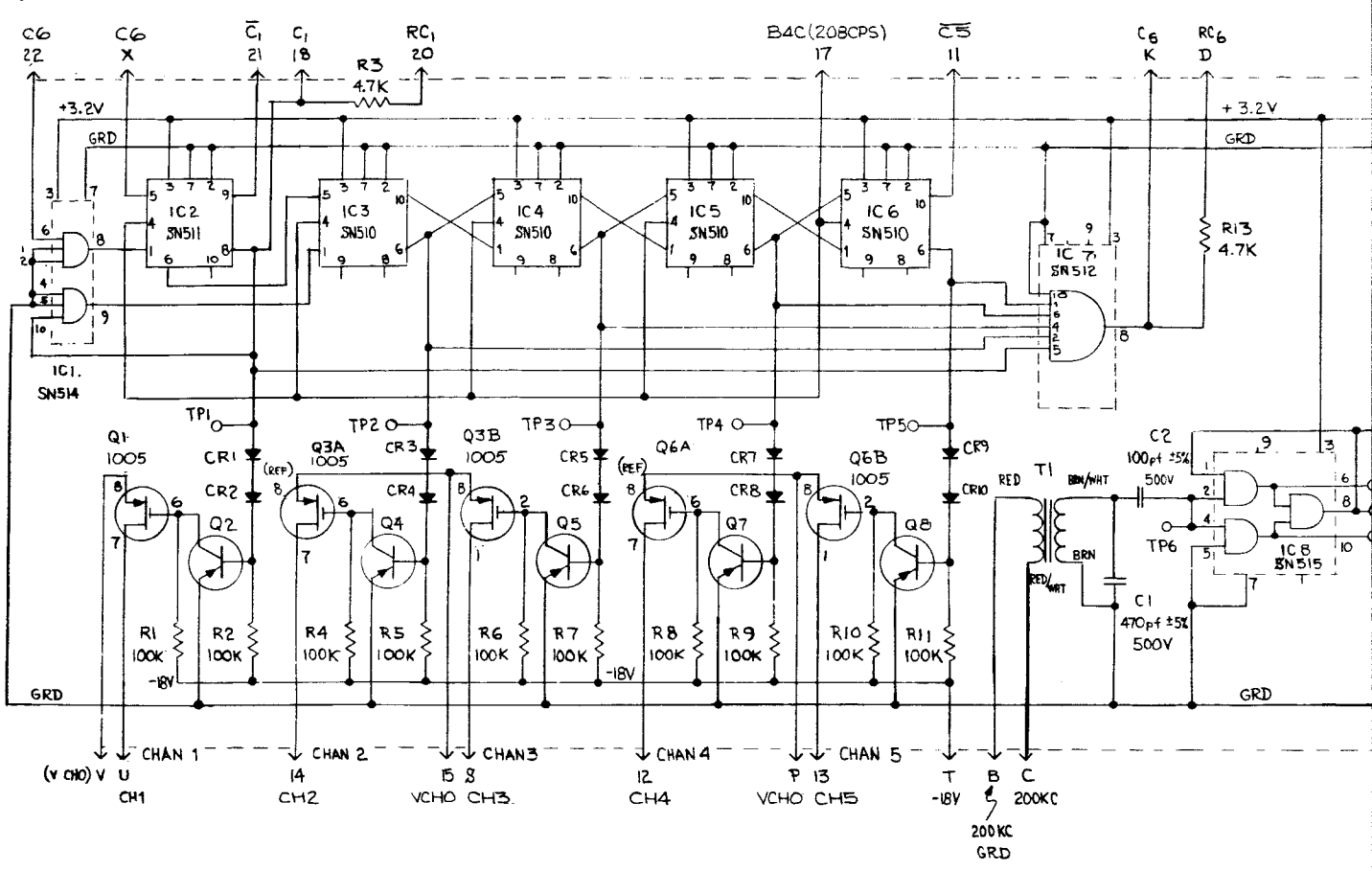
APPENDIX A

MRIR TELEMETRY UNIT

ELECTRICAL SCHEMATICS

AND

PRINTED CIRCUIT BOARD ASSEMBLY DRAWINGS



4. REF ASSY D
3. ALL RESISTO
2. ALL DIODES
1. ALL TRANSI
NOTE: UNLESS O

REVISIONS			
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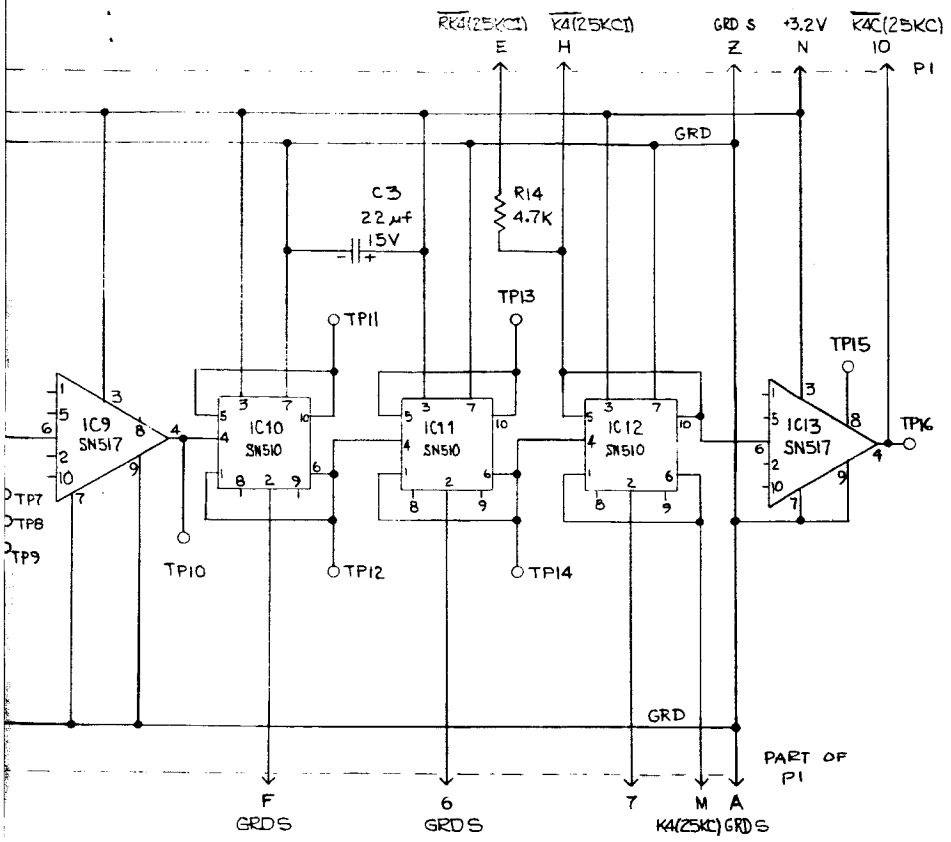

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UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03, .XXX ± .010
ANGLES: ± 0° 30'
DRILLED HOLES
.040 TO .1285: +.002, —.001
.136 TO .228: +.003, —.001
.234 TO .500: +.004, —.001
.515 TO .750: +.005, —.001
.765 TO 1.000: +.007, —.001
1.015 TO 2.000: +.010, —.001

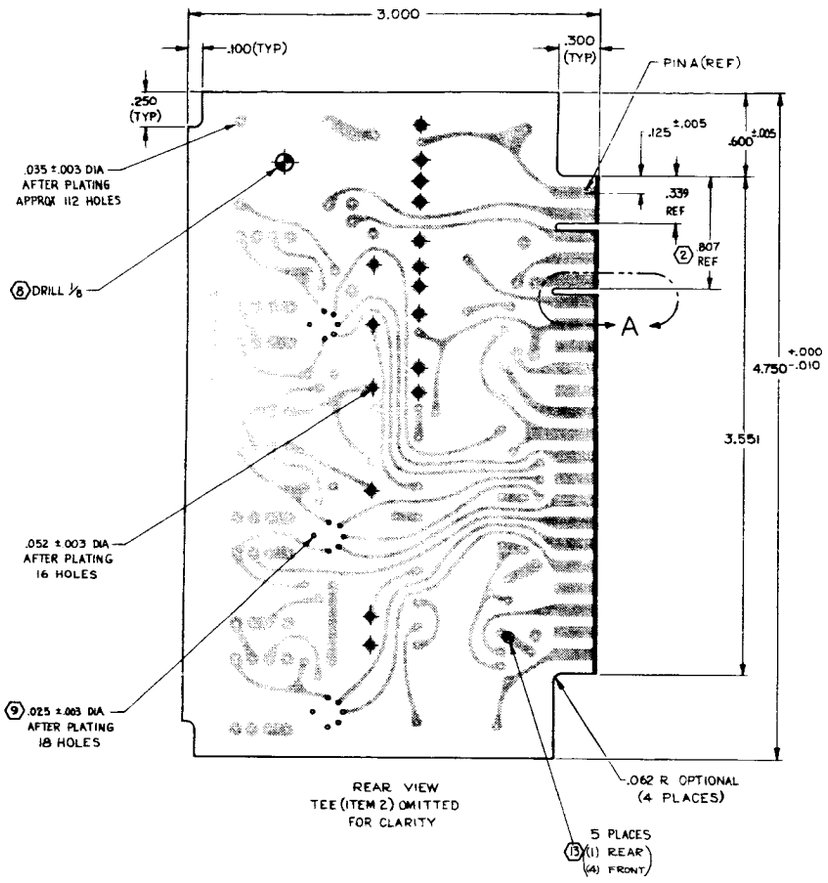
DRAWN	O. HAMPTON	12-6-65
CHECK		5-3-66
APPD		
APPD		
FINISH		
HEAT TREAT		
SURFACE ROUGHNESS PER MIL-STD-10	✓	

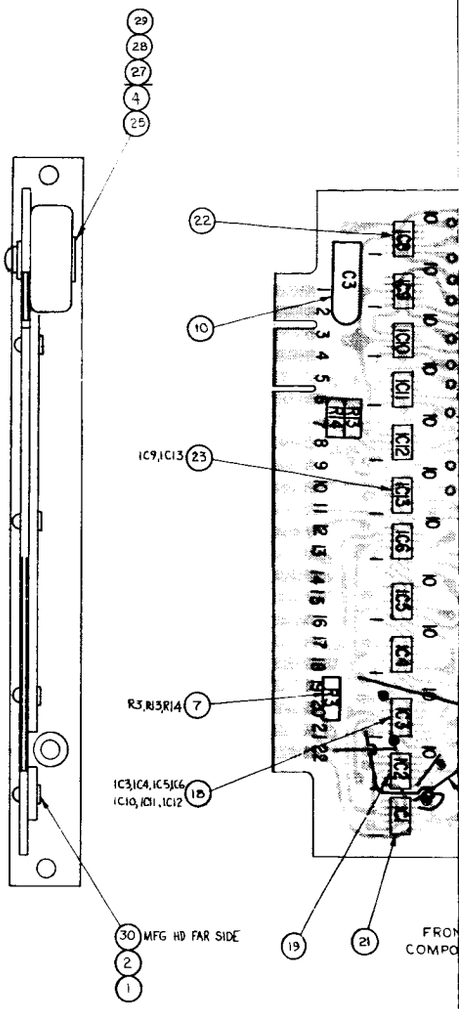
CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

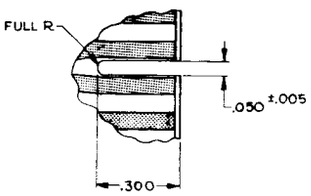
SCHEMATIC— ANALOG INPUTS & 25 KC GENERATOR

SCALE: NONE
SIZE: D
10350-502
DO NOT SCALE THIS DRAWING
WEIGHT
SHEET

VG NO. 10351-502
ES VALUES IN OHMS ± 2% AND ARE ¼ W
ARE IN4153
TORS ARE 2N2604
HERWISE SPECIFIED







DETAIL A
(2 PLACES)
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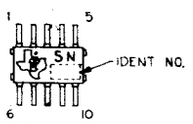

PIN ORIENTATION
OF MODULES
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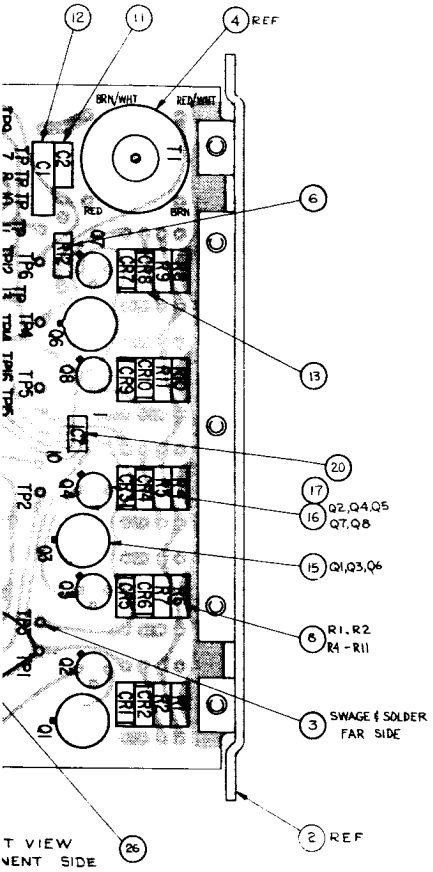

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29	1	MS35233-13	SCREW			
28	1	MS35338-70	WASHER-LK			
27	1	AN960C4L	WASHER-FLAT			
12 26	1		WIRE	#30	ENAMEL COATED	COML
7 25	1	100-1	RETAINER TOROID			COML
11 24	5	K-131	MOUNT-TRANSISTOR			
6 23	2	SN517	SOLID STATE MODULE	WITH MYLAR INSULATOR		COML
22	1	SN515				
21	1	SN514				
20	1	SN512				
19	1	SN511				
6 18	7	SN510	SOLID STATE MODULE	WITH MYLAR INSULATOR		COML
17	5		TRANSISTOR-MOUNT	TO-18		COML
6 16	5	2N2604	TRANSISTOR	TO-18		COML
5 15	3	1005	TRANSISTOR	TO-5		COML
10 13	10	IN4153	DIODE			COML
3 12	1	CYFM15C471G	CAPACITOR	470pf ±2% 500V		COML
3 11	1	CYFM10C101G	CAPACITOR	100pf ±2% 500V		COML
4 15	1	KG22J15KMS	CAPACITOR	22 µf ±10% 15V		COML
3 9	10	C07	RESISTOR	100K ±2% 1/4 W		COML
3 7	3	C07	RESISTOR	4.7K ±2% 1/4 W		COML
3 6	1	C07	RESISTOR	1K ±2% 1/4 W		COML
4	1	10003-403	TRANSFORMER			
3	16	910443-203	TERMINAL			DSCD
2	1	11412-203-11	TEE-PCB ASSY			
1	1	10351-502-3	PCB	.062 x 3.06 x 4.81	1	
ITEM NO.	1	10351-502	ANALOG INPUTS & 25KC GEN			

LIST OF MATERIAL OR PARTS LIST

(13) 22 CIRCUITRY TO BE CUT AT PLACES INDICATED BY ●
(12) 21 REA MAGNETIC WIRE CO INC; FORT WAYNE, IND
(11) 20 KIDWELL INC, VAN NUYS, CALIF
(10) 19 GENERAL ELECTRIC CO SEMICOND DIV; SYRACUSE, N.Y.
(9) 18 HOLES TO BE LANDLESS PER CCP SPEC A0105-007
(8) 17 DO NOT PLATE THRU
(7) 16 MODULAR ELECTRONICS; INGLEWOOD, CALIF
(6) 15 TEXAS INSTRUMENTS INC, DALLAS, TEXAS
(5) 14 GENERAL MICRO ELECTRONICS INC, SANTA CLARA, CALIF.
(4) 13 KEMET DEPT UNION CARBIDE CORP, CLEVELAND, OHIO
(3) 12 CORNING GLASS WORKS BRADFORD, PA
11 REF SCHEMATIC DWG NO. 10350-502
10 COMPONENT REF DESIGNATIONS ARE FOR LOCATING PURPOSES ONLY AND DO NOT APPEAR ON ACTUAL PART.
(2) 9 KEYSLOT DIMENSIONS ARE FOR REFERENCE ONLY, SLOT SHOULD BE CENTERED BETWEEN PINS AND MUST NOT TOUCH CIRCUITRY.
8 MATCH DRILL AND RIVET ITEMS 1 AND 2 USING JIG FIXTURE 11430-203
7 FABRICATE PER CCP SPEC A0105-007
6 SILK SCREEN USING SSM 10351-502-3
5 FABRICATE USING PCM 10351-502-3
(1) 4 EPOXY GLASS LAMINATE WITH 2 OZ COPPER BOTH SIDES, MIL-P-13949C, TYPE GE
3 PLATING:
a - COPPER PLATE HOLES .001 MIN
b - NICKEL PLATE HOLES AND CIRCUITRY .00050 MIN.
c - GOLD PLATE HOLES AND CIRCUITRY .000050 MIN.
2 CHAMFER CONNECTOR TIP .020 X 30° BOTH SIDES.
1 BOARD THICKNESS AT CONNECTOR TIP NOT TO EXCEED .065 +.008 -.005
NOTE: UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED	DRAWN	C. HAMPTON	28 MAR/64
DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ± .03 .XXX ± .010 ANGLES ± 0° 30'	CHECK		
	APPD		
	APPD		
DRILLED HOLES .040 TO .1285 +.002 -.001; .136 TO .228 +.003 -.001; .234 TO .500 +.004 -.001; .515 TO .750 +.005 -.001; .765 TO 1.000 +.007 -.001; 1.015 TO 2.000 +.010 -.001	FINISH		
	HEAT TREAT		
	SURFACE ROUGHNESS PER MIL-STD-10 ✓		

CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

ANALOG INPUTS & 25KC GENERATOR

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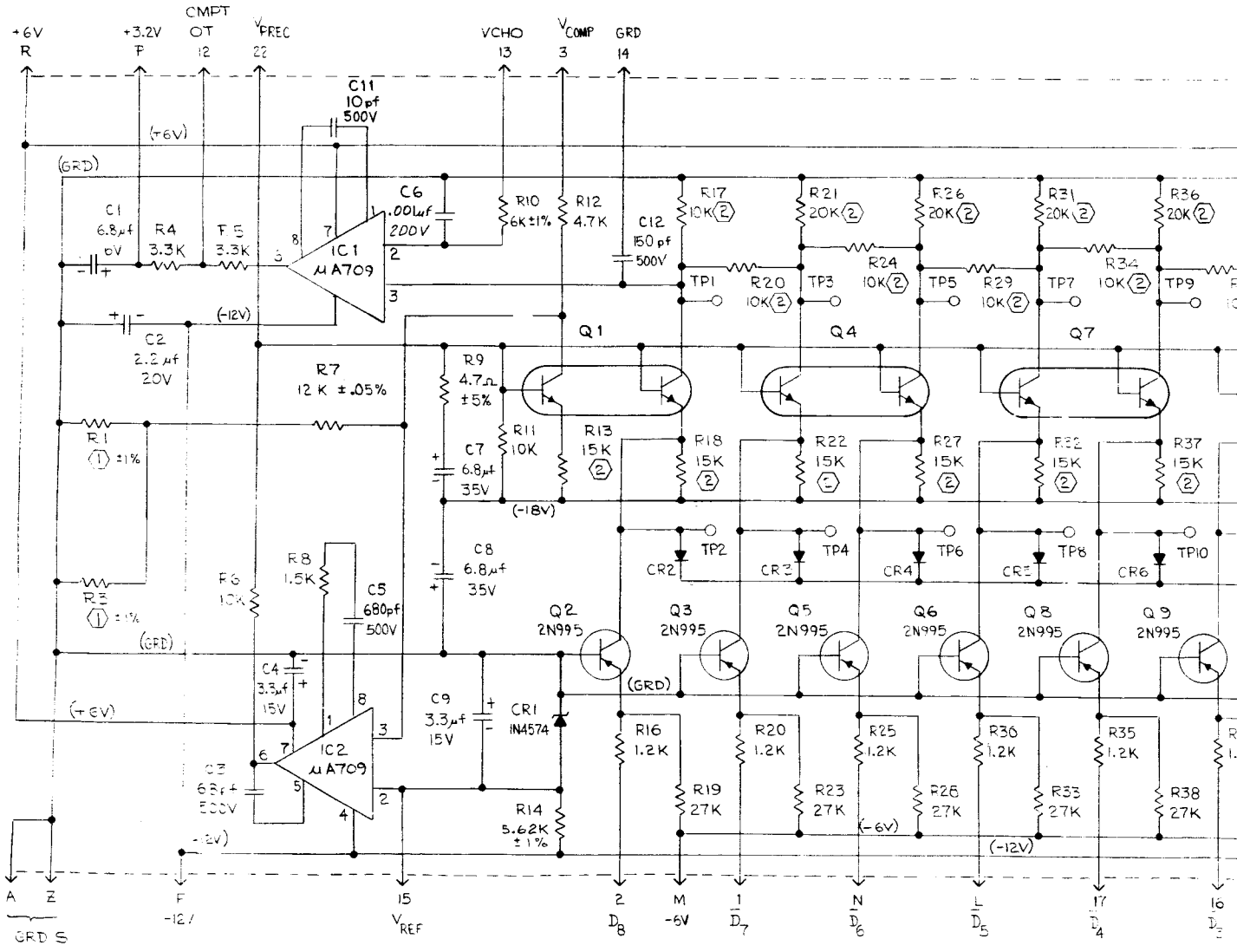
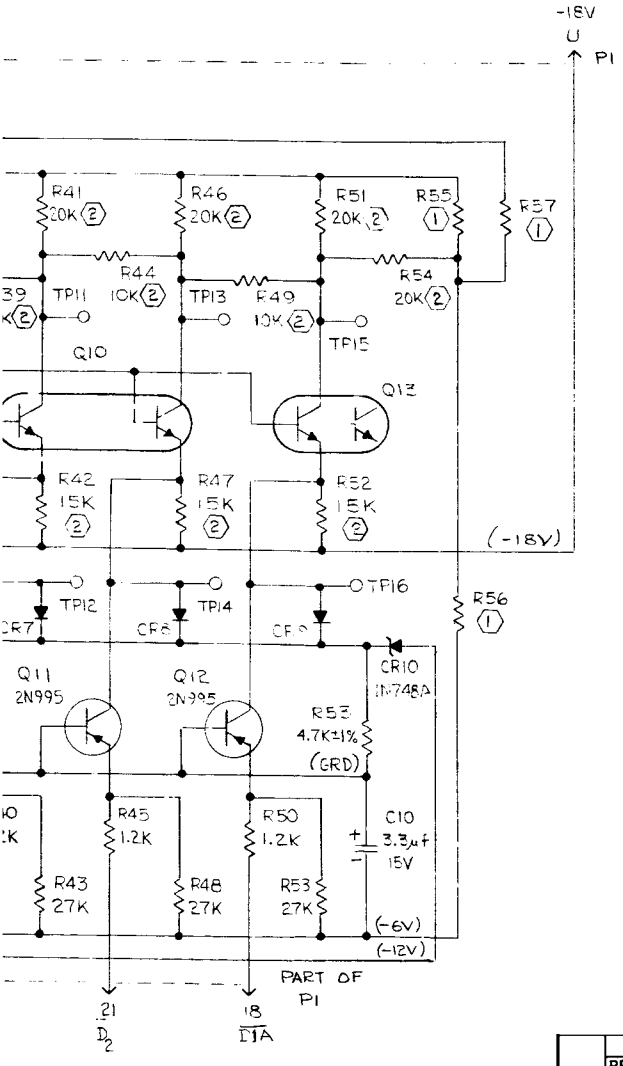
DO NOT SCALE THIS DRAWING	WEIGHT	SHEET

2



9. CAPACITOR
8. C11 & C12 LOCA
7. R2 & R15 OMI
6. REF ASSY
5. TRANSISTOR
4. DIODES ARE
(2) 3. VALUES ±0.0
(1) 2. VALUE TO BE
1. RESISTOR
NOTE: UNLESS

REVISIONS			
SYM	ZONE	DESCRIPTION	DATE & APPROVAL
		[1] MAY BE REWORKED [2] CANNOT BE REWORKED [3] NONE	



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ED OUT OF SEQUENCE
TED
WG NO. 10367-502
ARE 2N2453
IN4152
% 0.1W
DETERMINED AT FUNCTIONAL TEST
LUES ARE IN OHMS ±2% AND ARE 1/4W
THERWISE SPECIFIED

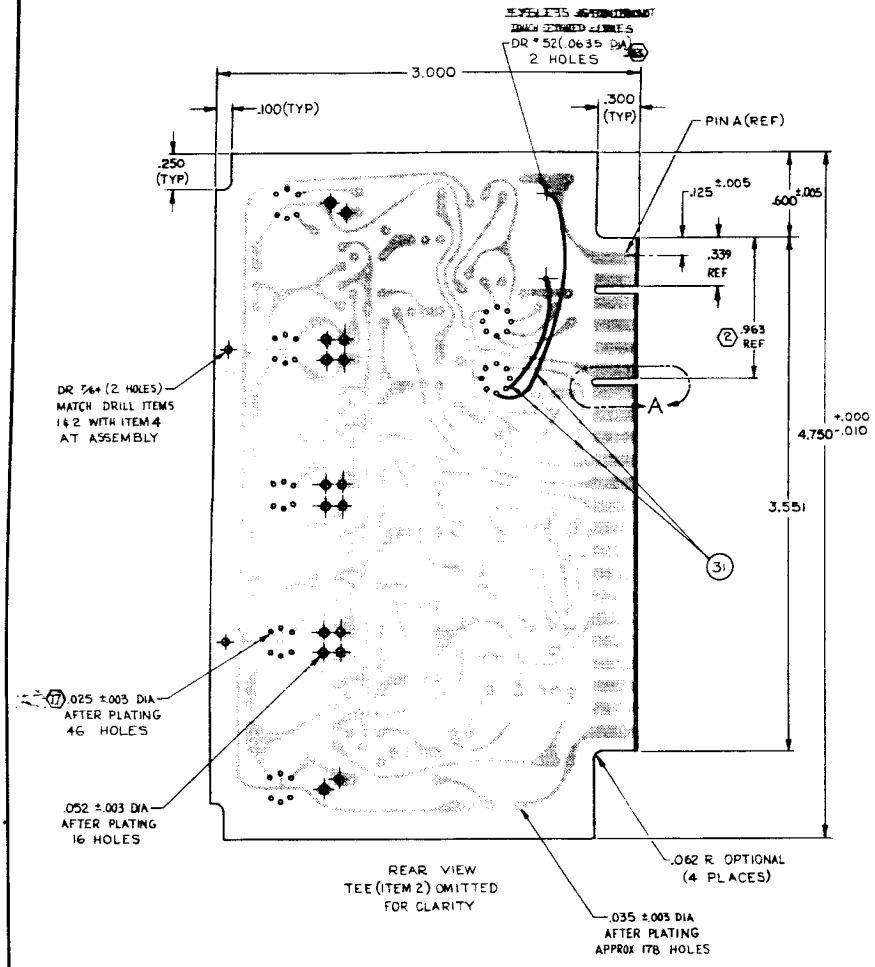
UNLESS OTHERWISE SPECIFIED		DRAWN	O. Hampton	5 Oct 64
DIMENSIONS ARE IN INCHES		CHECK		
TOLERANCES ON		APPD		
DECIMALS	ANGLES	APPD		
.XX ± .03	± 0° 30'			
.XXX ± .010				
DRILLED HOLES		FINISH		
.040	TO .1285: + .002, — .001			
.136	TO .228: + .003, — .001	HEAT TREAT		
.234	TO .500: + .004, — .001			
.515	TO .750: + .005, — .001			
.765	TO 1.000: + .007, — .001			
1.015	TO 2.000: + .010, — .001	SURFACE ROUGHNESS PER MIL-STD-10	✓	

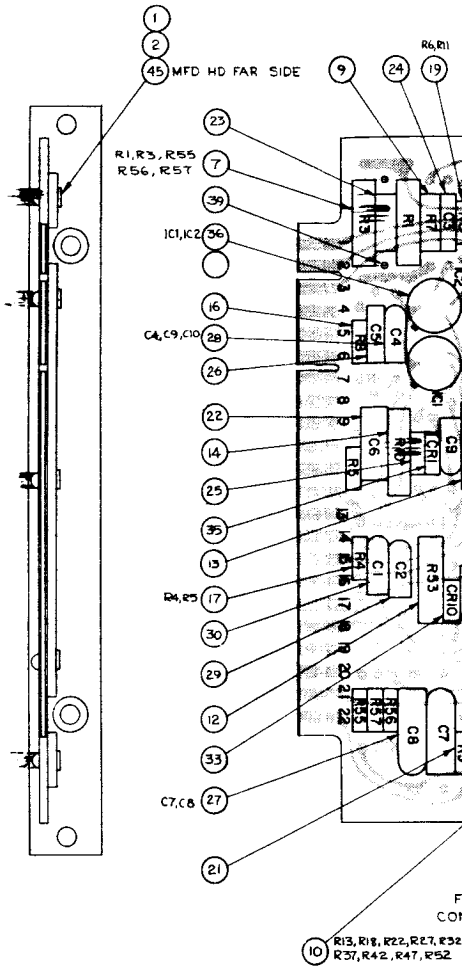
CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

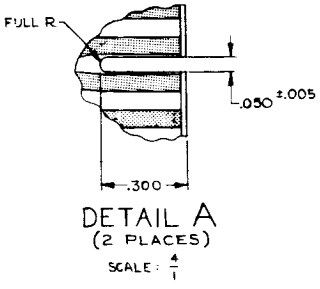
SCHEMATIC-
ANALOG/DIGITAL CONVERTER

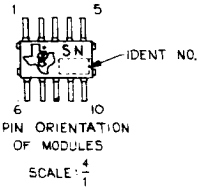
SCALE:	SIZE	
NONE	D	10368-502
DO NOT SCALE THIS DRAWING	WEIGHT	SHEET

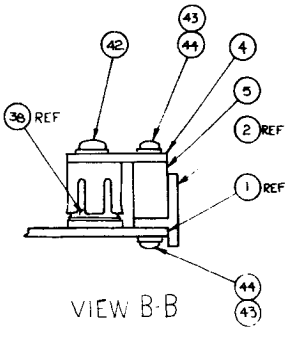
2


DR #52(.0635 DIA)
2 HOLES
3.000
.100(TYP)
.300
(TYP)
.250
(TYP)
PIN A(REF)
.125 ±.005
.600 ±.005
.339
REF
.963
REF
DR 7/64 (2 HOLES)
MATCH DRILL ITEMS
1&2 WITH ITEM 4
AT ASSEMBLY
A
+.000
4.750 -.010
3.551
.025 ±.003 DIA
AFTER PLATING
46 HOLES
.052 ±.003 DIA
AFTER PLATING
16 HOLES
.062 R OPTIONAL
(4 PLACES)
.035 ±.003 DIA
AFTER PLATING
APPROX 178 HOLES
REAR VIEW
TEE (ITEM 2) OMITTED
FOR CLARITY

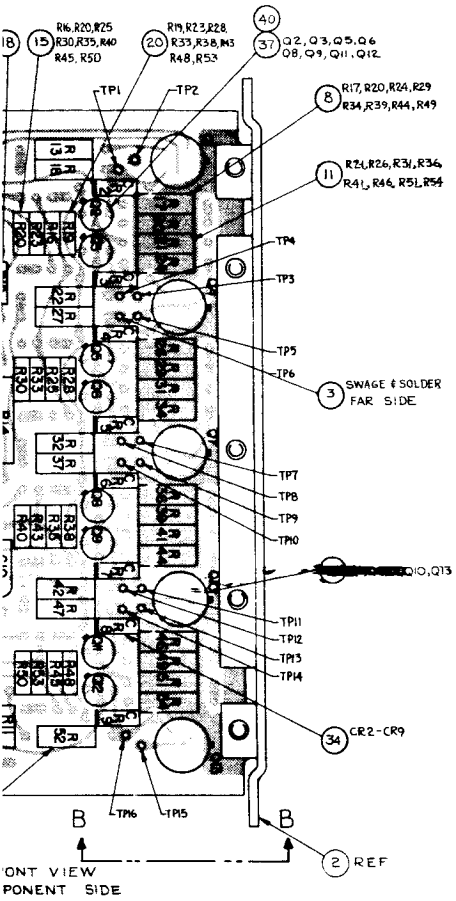

MFD HD FAR SIDE
R1,R3,R55
R56,R57
IC1,IC2
C4,C9,C10
R4,R5
C7,C8
R13,R18,R22,R27,R32
R37,R42,R47,R52


FULL R
.050 ±.005
.300
DETAIL A
(2 PLACES)
SCALE: 4/1


1
5
S N
IDENT NO.
6
10
PIN ORIENTATION
OF MODULES
SCALE: 4/1


REF
REF
REF
VIEW B-B

REVISIONS			
SYM	ZONE	DESCRIPTION	DATE & APPROVAL
		1 MAY BE REWORKED 2 CANNOT BE REWORKED 3 NONE	



ITEM NO.	REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION			ZONE
45	5	MS20470A2-4	RIVET				
44	4	MS35233-3	SCREW				
43	4	MS35333-69	WASHER-LOCK				
(12) 42	5	30022	RETAINER-TRANSISTOR	TO-5		COML	
(18) 40	8	JK-J31	MOUNT-TRANSISTOR	TO-18		COML	
(15) 39	2	SE-22	EYELET				
(11) 38	5	2N2453	TRANSISTOR			COML	
(11) 37	8	2N995	TRANSISTOR				
(11) 36	2	μA709	OPR AMPLIFIER				
(10) 35	1	IN4574	DIODE				
(9) 34	8	IN4153	DIODE				
(10) 33	1	IN748A	DIODE			COML	
(16) 31	\		WIRE	#30	ENAMEL COATED	COML	
(8) 30	1	KG6R8J6KMS	CAPACITOR	6.8μf ±10% 6V		COML	
29	1	KG2R2J20KMS		2.2μf ±10% 20V			
28	3	KG3R3J15KMS		3.3μf ±10% 15V			
(8) 27	2	KG6R8J35KMS		6.8μf ±10% 35V			
(6) 26	1	CYFM15C681G		680pf ±2% 300V			
25	1	CYFM10C151G		150pf ±2% 500V			
24	1	CYFM10C680G		68pf ±2% 500V			
(6) 23	1	CYFM10C100G		10pf ±2% 500V			
(7) 22	1	64F10BC102	CAPACITOR	.001 ±5% 200V			
(14) 21	1	CB4765	RESISTOR	4.7Ω ±5% ¼W			
(6) 20	8	CO7		27K ±2% ¼W			
19	2			10K			
18	1			4.7K			
17	2			3.3K			
16	1			1.5K			
(6) 15	8	CO7		1.2K ±2% ¼W			
(5) 14	1	MEA-TO		6K ±1% ⅛W			
(5) 13	1	MEA-TO		5.62K ±1% ⅛W			
(5) 12	1	MEA-TO		4.7K ±1% ⅛W			
(4) 11	8	1318P		20K ±.05% .1W			
10	9			15K			
9	1			12K			
(4) 8	8	1318P		10K ±.05% .1W			
7	5		RESISTOR	(3)		COML	
5	2	11519-203	SPACER				
4	1	11438-203	HEAT SINK-TRANSISTOR				
3	16	90443-203	TERMINAL			DSCD	
2	1	11412-203-51	TEE-PCB ASSY				
1	1	10367-502-3	PCB	.062 x 3.06 x 4.81	(1)		

LIST OF MATERIAL OR PARTS LIST

(18) 27. KIDWELL INC. VAN NUYS, CALIF
(17) 26. TO BE LANDLESS HOLES PER CCP SPEC A0105-007
(16) 25 REA MAGNETIC WIRE CO INC; FORT WAYNE, IND
(15) 24 UNITED SHOE MACHINERY CORP, BOSTON, MASS.
(14) 23 ALLEN BRADLEY CO, MILWAUKEE, WISCONSIN
(13) 22. DO NOT PLATE THRU
(12) 21. NATIONAL BERYLLIA CORP; HASKELL, N. J.
(11) 20. FAIRCHILD SEMICOND DIV; MOUNTAIN VIEW, CALIF
(10) 19 MOTOROLA SEMICOND PROD; PHOENIX, ARIZ.
(9) 18 GENERAL ELECTRIC SEMICOND DIV. SYRACUSE, N.Y.
(8) 17. KEMET DEPT UNION CARBIDE CORP CLEVELAND, OHIO
(7) 16. GENERAL ELECTRIC CO., SCHENECTADY, N.Y.
(6) 15 CORNING GLASS WORKS, BRADFORD, PA.
(5) 14 I.R.C. ; PHILADELPHIA, PA
(4) 13 KELVIN VAN NUYS, CALIF
(3) 12. VALUE TO BE DETERMINED AT FUNCTIONAL TEST
11. REF SCHEMATIC DWG NO. 10368-502
10. COMPONENT REF DESIGNATIONS ARE FOR LOCATING PURPOSES ONLY AND DO NOT APPEAR ON ACTUAL PART.
(2) 9. KEYSLOT DIMENSIONS ARE FOR REFERENCE ONLY, SLOT SHOULD BE CENTERED BETWEEN PINS AND MUST NOT TOUCH CIRCUITRY.
8. MATCH DRILL AND RIVET ITEMS 1 AND 2 USING JIG FIXTURE 11430-203
7. FABRICATE PER CCP SPEC A0105-007
6. SILK SCREEN USING SSM 10367-502-3
5. FABRICATE USING PCM 10367-502-3
(1) 4. EPOXY GLASS LAMINATE WITH 2 OZ COPPER BOTH SIDES, MIL-P-13949C, TYPE GE
3. PLATING:
a - COPPER PLATE HOLES .001 MIN
b - NICKEL PLATE HOLES AND CIRCUITRY .000050 MIN.
c - GOLD PLATE HOLES AND CIRCUITRY .000050 MIN.
2. CHAMFER CONNECTOR TIP .020 X 30° BOTH SIDES.
1. BOARD THICKNESS AT CONNECTOR TIP NOT TO EXCEED .065 +.003 -.008
NOTE: UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED	DRAWN	G. HAMPTON	28 MAY 74
DIMENSIONS ARE IN INCHES	CHECK		
TOLERANCES ON DECIMALS XX ± .03 XXX ± .010 ANGLES ± 0° 30'	APPD		
	APPD		
DRILLED HOLES .040 TO .1285 +.002,-.001; .136 TO .228 +.003,-.001; .234 TO .500 +.004,-.001; .515 TO .750 +.005,-.001; .765 TO 1.000 +.007,-.001; 1.015 TO 2.000 +.010,-.001	FINISH		
	HEAT TREAT		
SURFACE ROUGHNESS PER MIL-STD-10 ✓	SCALE: 2/1	DO NOT SCALE THIS DRAWING	

CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

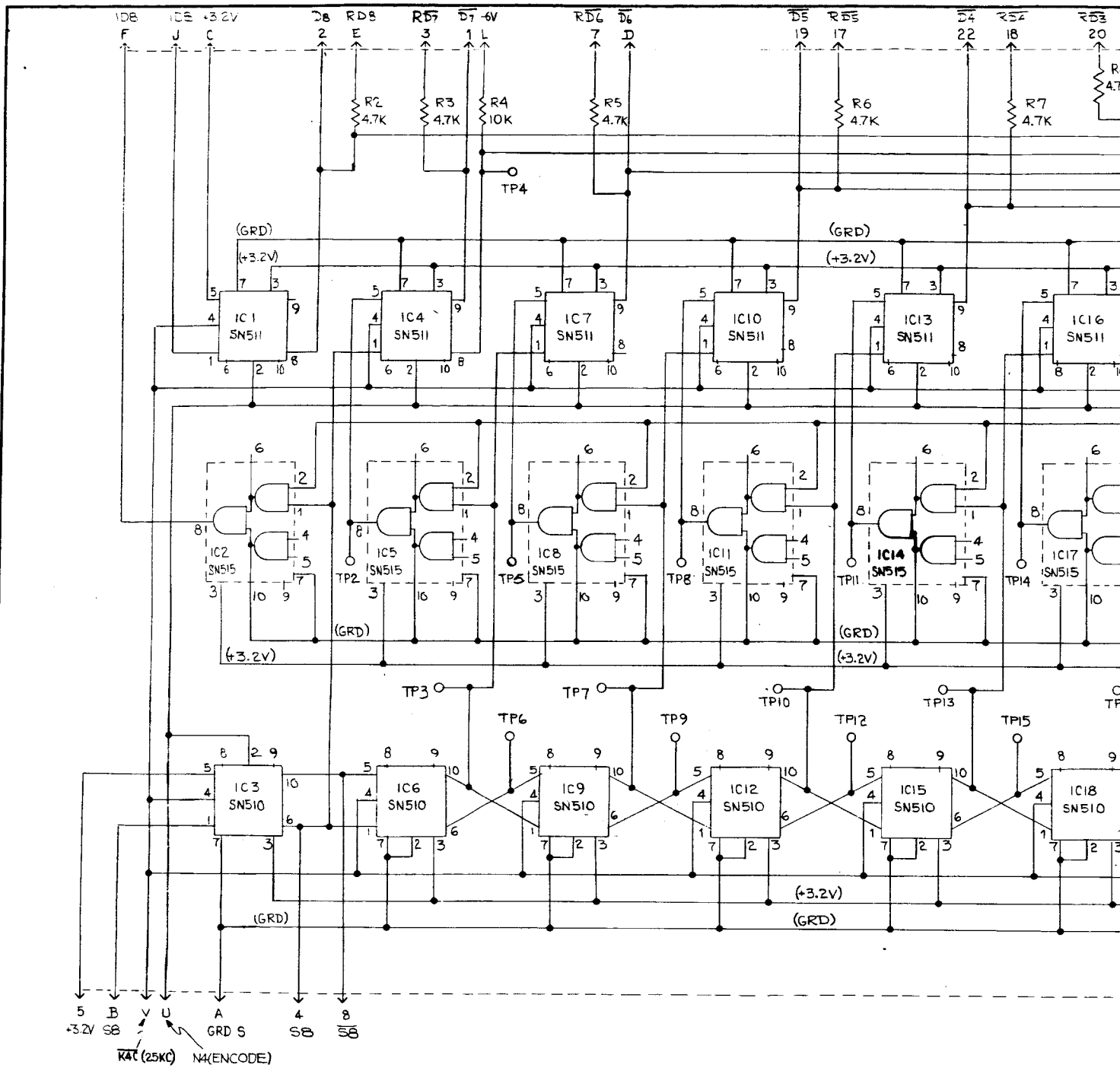
ANALOG/DIGITAL CONVERTER

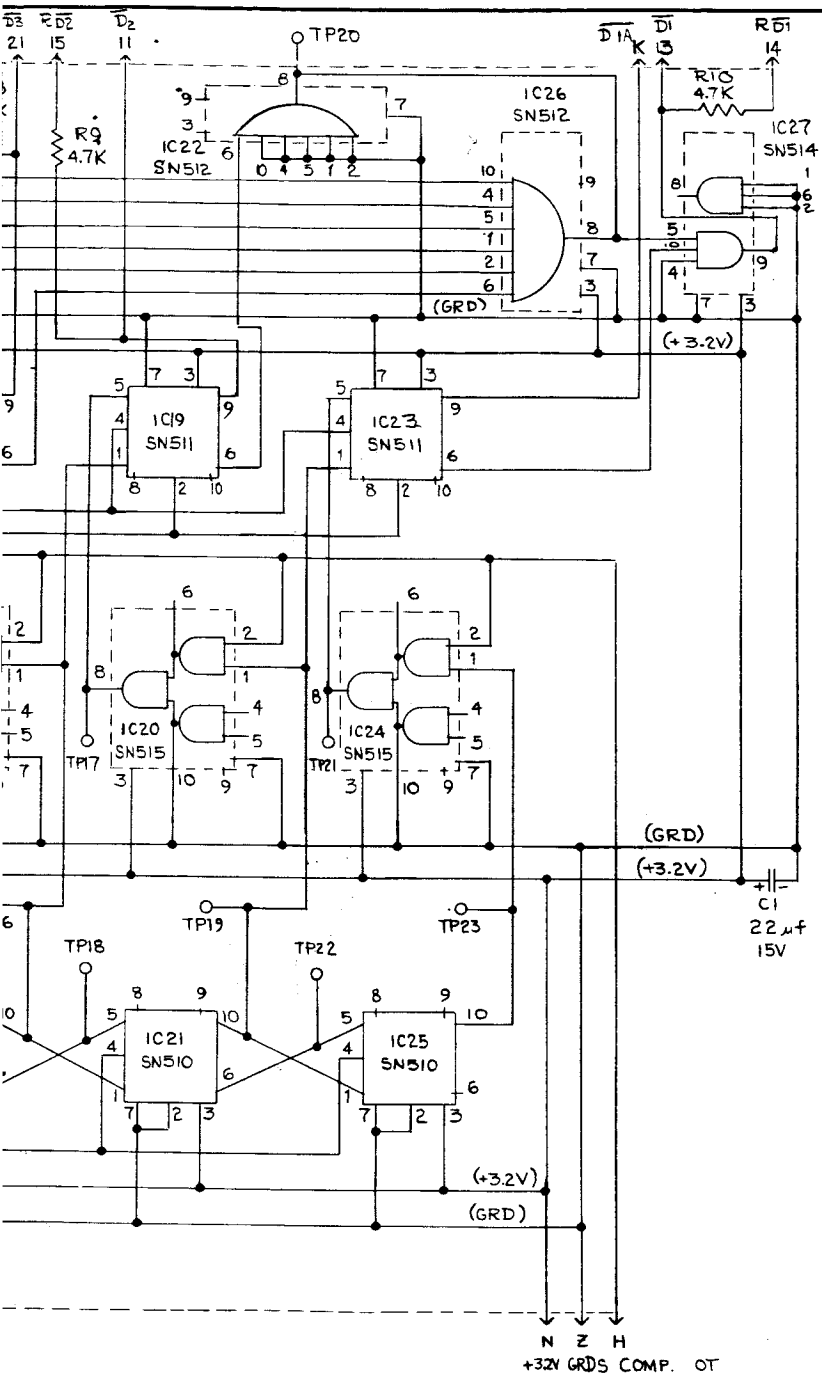
SIZE F — 10367-502

WEIGHT — SHEET

10367-0021

2


IDB F
IDS J
+3.2V C
D8 2
RD8 E
RD7 3
D7 1
-6V L
RD6 7
D6 D
D5 19
RD5 17
D4 22
RD4 18
RD3 20
R2 4.7K
R3 4.7K
R4 10K
R5 4.7K
R6 4.7K
R7 4.7K
TP4
(GRD)
(+3.2V)
IC1 SN511
IC4 SN511
IC7 SN511
IC10 SN511
IC13 SN511
IC16 SN511
IC2 SN515
IC5 SN515
IC8 SN515
IC11 SN515
IC14 SN515
IC17 SN515
TP2
TP5
TP8
TP11
TP14
TP3
TP7
TP10
TP13
TP6
TP9
TP12
TP15
IC3 SN510
IC6 SN510
IC9 SN510
IC12 SN510
IC15 SN510
IC18 SN510
5 +3.2V
B S8
V
U
A GRD S
4 S8
8 S8
K4C (25KC)
N4(ENCODE)



REVISIONS			
SYM	ZONE	DESCRIPTION	DATE & APPROVAL
		[1] MAY BE REWORKED [2] CANNOT BE REWORKED [3] NONE	

	REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION	ZONE
	1	10366-502	SCHEMATIC		

LIST OF MATERIAL OR PARTS LIST

PIERI ARE NOT USED
REF ASSY DWG NO. 10365-502
RESISTOR VALUES ARE IN OHMS ±2% AND ARE ¼W
UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ±.03, .XXX ±.010 | ANGLES ±0° 30'

DRILLED HOLES

.040	TO .1285: +.002, —.001	
.136	TO .228: +.003, —.001	
.234	TO .500: +.004, —.001	
.515	TO .750: +.005, —.001	
.765	TO 1.000: +.007, —.001	
1.015	TO 2.000: +.010, —.001	

DRAWN	O. HAMPTON	18 DEC 1965
CHECK		5-3-66
APPD		
APPD		

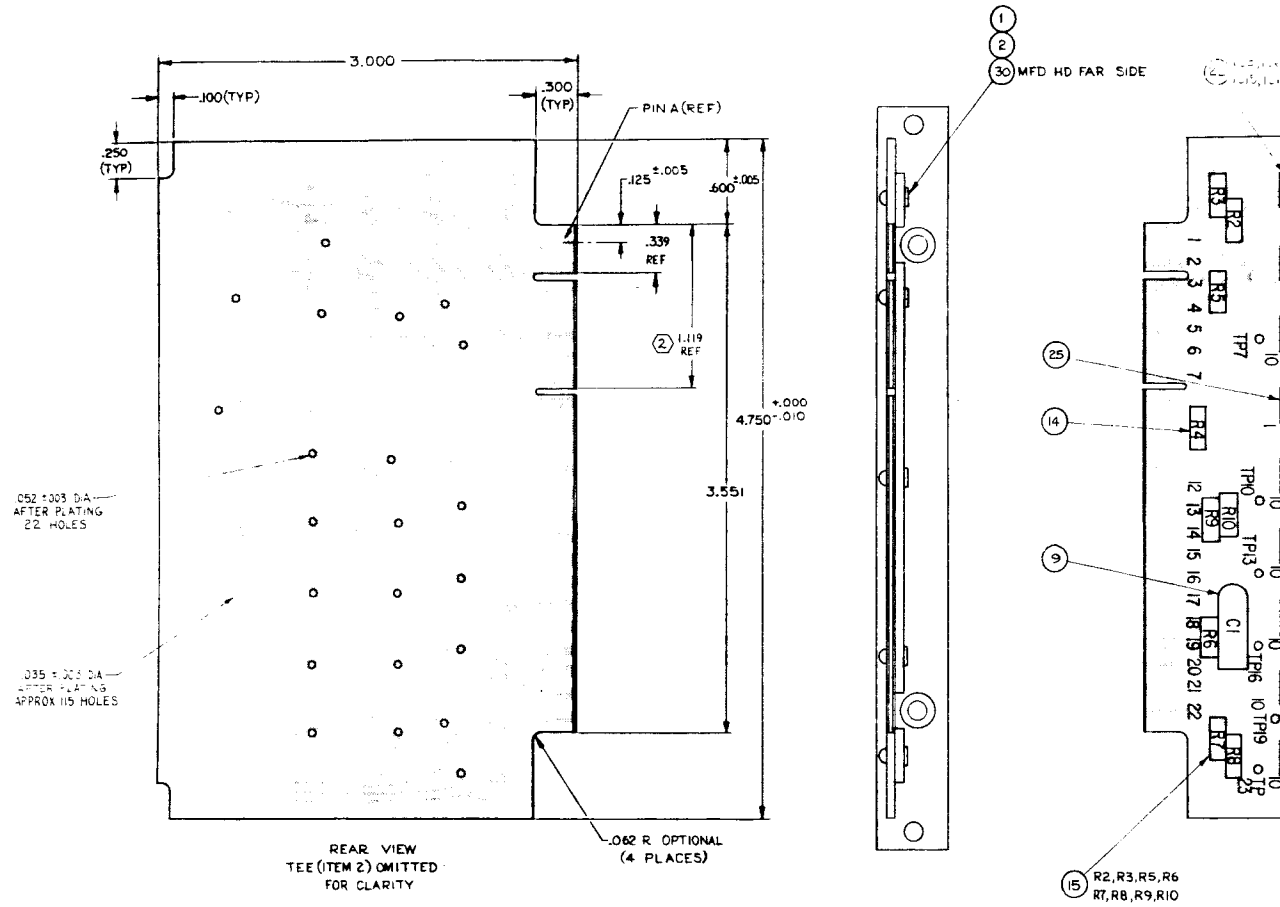
FINISH
HEAT TREAT
SURFACE ROUGHNESS PER MIL-STD-10 ✓
DO NOT SCALE THIS DRAWING

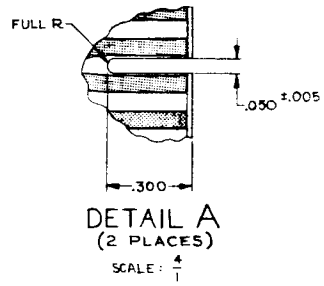
CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

SCHEMATIC - ANALOG TO DIGITAL DATA CONTROL

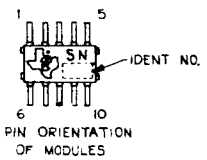
SCALE: NONE | SIZE: D | 10366-502
WEIGHT | SHEET

2



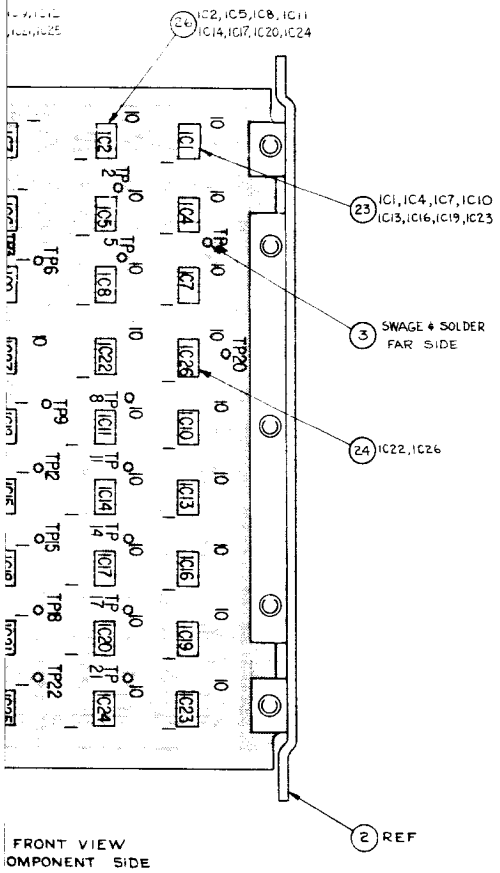


DETAIL A
(2 PLACES)
SCALE: 4/1



PIN ORIENTATION
OF MODULES
SCALE: 4/1

REVISIONS			
SYM	ZONE	DESCRIPTION	DATE & APPROVAL
		2 CANNOT BE REWORKED 3 NONE	



FRONT VIEW
OMPONENT SIDE

ITEM NO.	REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION		ZONE
30	5	MS20470A2-4	RIVET			
(5) 26	8	SN515	SOLID STATE MODULE WITH MYLAR INSULATOR			COML
25	1	SN514				
24	2	SN512				
23	8	SN511				
(5) 22	8	SN510	SOLID STATE MODULE WITH MYLAR INSULATOR			COML
(4) 15	8	C07	RESISTOR	4.7K ±2% 1/4 W		COML
(4) 14	1	C07	RESISTOR	10K ±2% 1/4 W		COML
(3) 9	1	KG22J15KMS	CAPACITOR	22 μf ±10% 15V		COML
3	22	910443-203	TERMINAL			DSCD
2	1	11412-203-41	TEE-PCB ASSY			
1	1	10365-502-3	PCB	.062 x 3.06 x 4.6	(1)	
ITEM NO.	1	10365-502	A/D DATA CONTROL			

LIST OF MATERIAL OR PARTS LIST

(5) 14 TEXAS INSTRUMENTS INC; DALLAS, TEXAS
(4) 13 CORNING GLASS WORKS; PHILADELPHIA, PA
(3) 12 KEMET DEPT UNION CARBIDE CORP, CLEVELAND, OHIO
11. REF SCHEMATIC DWG NO. 10366-502
10. COMPONENT REF DESIGNATIONS ARE FOR LOCATING PURPOSES ONLY AND DO NOT APPEAR ON ACTUAL PART.
(2) 9. KEYSLOT DIMENSIONS ARE FOR REFERENCE ONLY, SLOT SHOULD BE CENTERED BETWEEN PINS AND MUST NOT TOUCH CIRCUITRY.
8. MATCH DRILL AND RIVET ITEMS 1 AND 2 USING JIG FIXTURE 11430-203
7. FABRICATE PER CCP SPEC A0105-007
6. SILK SCREEN USING SSM 10365-502-3 REV A
5. FABRICATE USING PCM 10365-502-3 REV A
(1) 4. EPOXY GLASS LAMINATE WITH 2 OZ COPPER BOTH SIDES, MIL-P-13949C, TYPE GE
3. PLATING:
a - COPPER PLATE HOLES .001 MIN
b - NICKEL PLATE HOLES AND CIRCUITRY .00050 MIN.
c - GOLD PLATE HOLES AND CIRCUITRY .000050 MIN.
2. CHAMFER CONNECTOR TIP .020 X 30° BOTH SIDES.
1. BOARD THICKNESS AT CONNECTOR TIP NOT TO EXCEED .065 +.008 -.008
NOTE: UNLESS OTHERWISE SPECIFIED

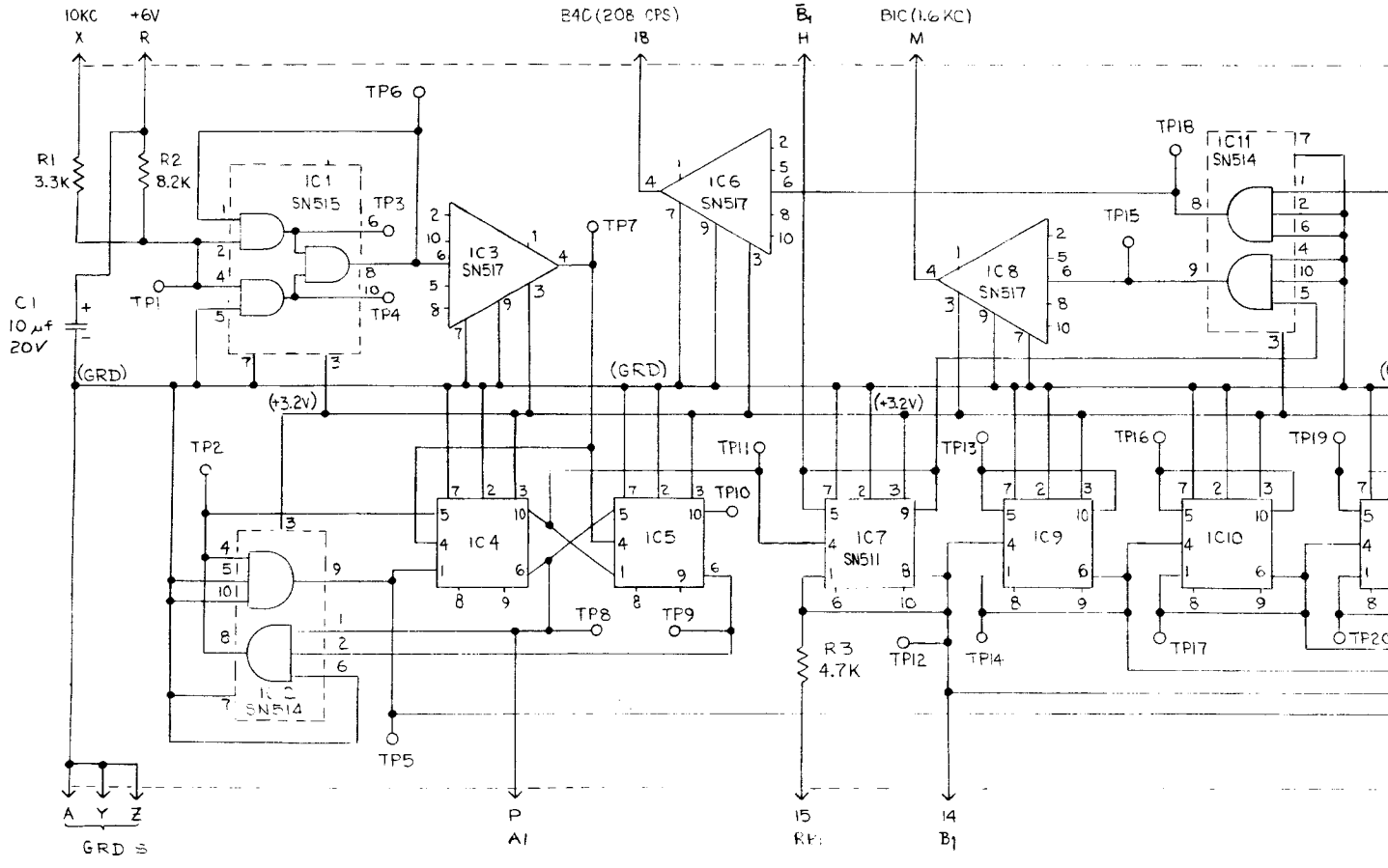
UNLESS OTHERWISE SPECIFIED	DRAWN	G. HAMPTON	26 MAY 71
DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS: XX ± .03, XXX ± .010 ANGLES: ± 0° 30'	CHECK		
	APPD		
	APPD		
DRILLED HOLES .040 TO .1285: +.002, —.001 .136 TO .228: +.003, —.001 .234 TO .500: +.004, —.001 .515 TO .750: +.005, —.001 .765 TO 1.000: +.007, —.001 1.015 TO 2.000: +.010, —.001	FINISH		
	HEAT TREAT		
SURFACE ROUGHNESS PER MIL-STD-10 ✓	DO NOT SCALE THIS DRAWING		

CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

ANALOG/DIGITAL DATA CONTROL

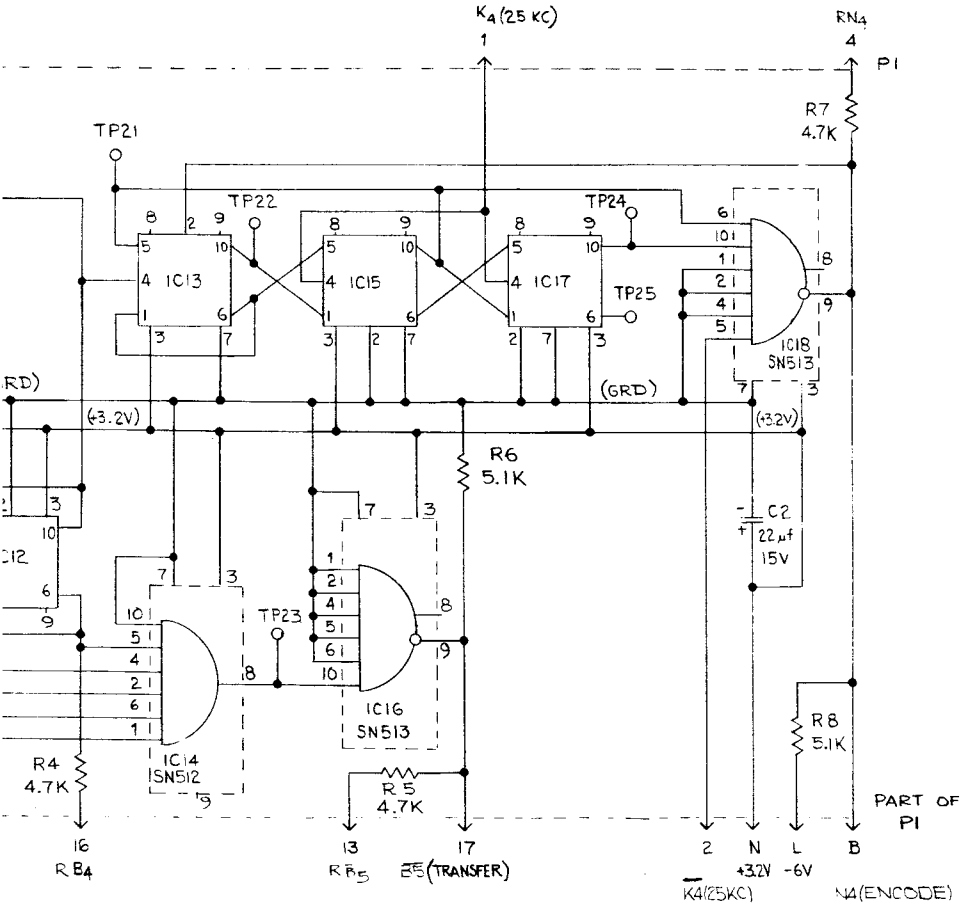
SCALE: 2/1	SIZE: F	10365-502
WEIGHT	SHEET	

2



3. REFER
2. RESIS
1. ALL IN
NOTE: UN

REVISIONS			
SYM	ZONE	DESCRIPTION	DATE & APPROVAL
		[1] MAY BE REWORKED [2] CANNOT BE REWORKED [3] NONE	D-ECN C-ENG



NCE ASSY LVG NO. 10353-502
TOR VALUES ARE IN OHMS ±2% AND ARE 1/4W
EGRATED CIRCUITS ARE SN510
ESS OTHERWISE SPECIFIED

REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION	ZONE
1	10352-502	SCHEM		

LIST OF MATERIAL OR PARTS LIST

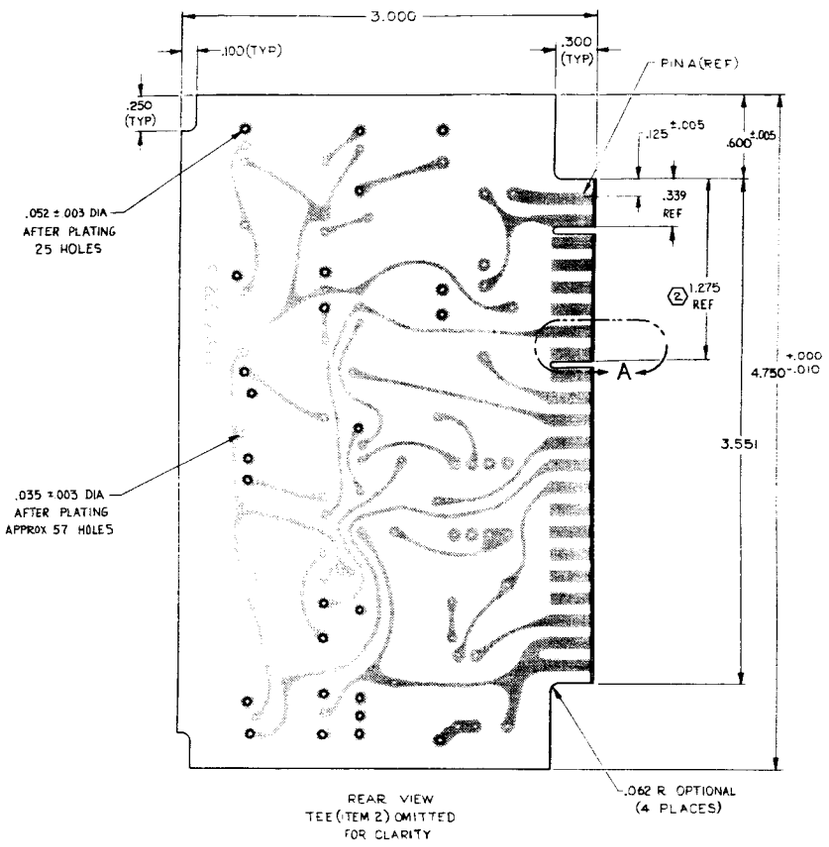
UNLESS OTHERWISE SPECIFIED			
DIMENSIONS ARE IN INCHES	DRAWN	O. HAMPTON	12-9-65
TOLERANCES ON	CHECK		5-3-66
DECIMALS: .XX ± .03, .XXX ± .010 — ANGLES: ± 0° 30'	APPD		
DRILLED HOLES: .040 TO .1285: +.002, —.001; .136 TO .228: +.003, —.001; .234 TO .500: +.004, —.001; .515 TO .750: +.005, —.001; .765 TO 1.000: +.007, —.001; 1.015 TO 2.000: +.010, —.001	APPD		
FINISH			
HEAT TREAT			
SURFACE ROUGHNESS PER MIL-STD-10 ✓			

CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

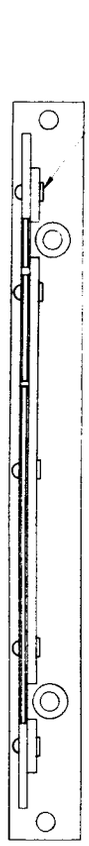
SCHEMATIC - ENCODE-TIMING GENERATOR

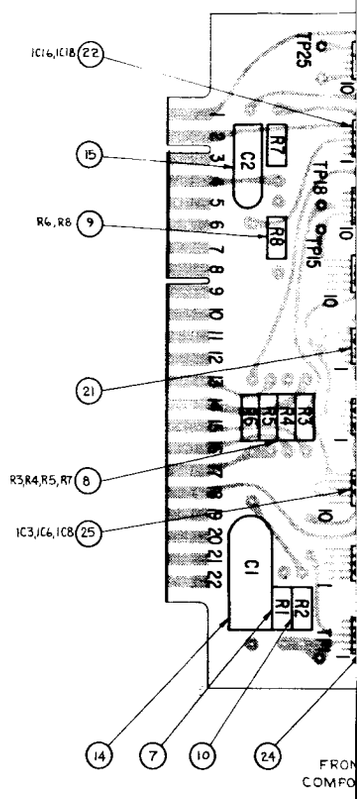
SCALE:	SIZE	
NONE	D	10352-502
DO NOT SCALE THIS DRAWING	WEIGHT	SHEET

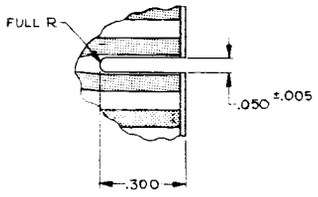
2



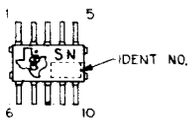
REAR VIEW
TEE (ITEM 2) OMITTED
FOR CLARITY





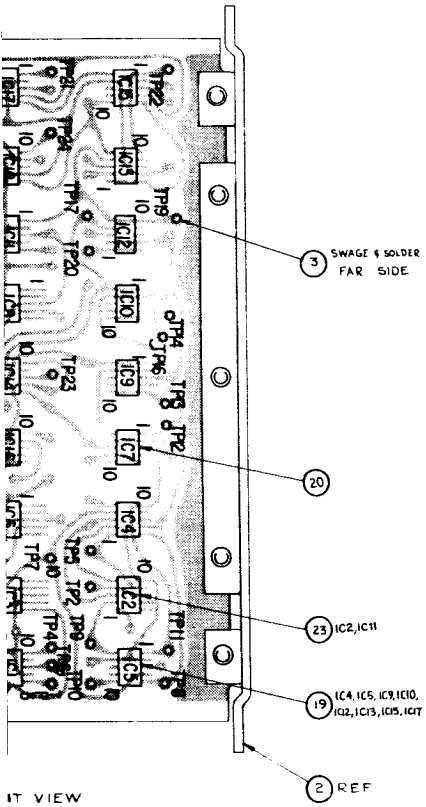


DETAIL A
(2 PLACES)
SCALE: 4/1



PIN ORIENTATION
OF MODULES
SCALE: 4/1

REVISIONS			
SYM	ZONE	DESCRIPTION	DATE & APPROVAL
		[1] MAY BE REWORKED [2] CANNOT BE REWORKED [3] NONE	



IT VIEW
NENT SIDE

ITEM NO.	REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION	ZONE
30	5	MS20470A2-4	RIVET		
(5) 25	3	SN517	SOLID STATE MODULE WITH MYLAR INSULATOR		COML
24	1	SN515			
23	2	SN514			
22	2	SN513			
21	1	SN512			
20	1	SN511			
(5) 19	8	SN510	SOLID STATE MODULE WITH MYLAR INSULATOR		COML
(4) 15	1	KG22J15KMS	CAPACITOR	22 μf ±10% 15V	COML
(4) 14	1	KG10J20KMS	CAPACITOR	10 μf ±10% 20V	COML
(3) 10	1	C07	RESISTOR	8.2K ±2% ¼W	COML
9	2			5.1K	
8	4			4.7K	
(3) 7	1	C07	RESISTOR	3.3K ±2% ¼W	COML
3	25	9.0443-203	TERMINAL		DSCD
2	1	11412-203-21	TEE-PCB ASSY		
1	1	10353-502-3	PCB	.062 × 3.06 × 4.81 (1)	
ITEM NO.	REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION	ZONE

LIST OF MATERIAL OR PARTS LIST

(5) 14. TEXAS INSTRUMENTS INC, DALLAS, TEXAS.
(4) 13. KEMET DEPT UNION CARBIDE INC, CLEVELAND, OHIO
(3) 12. CORNING GLASS WORKS, BRADFORD, PA
11. REF SCHEMATIC DWG NO. 10352-502
10. COMPONENT REF DESIGNATIONS ARE FOR LOCATING PURPOSES ONLY AND DO NOT APPEAR ON ACTUAL PART.
(2) 9. KEYSLOT DIMENSIONS ARE FOR REFERENCE ONLY, SLOT SHOULD BE CENTERED BETWEEN PINS AND MUST NOT TOUCH CIRCUITRY.
8. MATCH DRILL AND RIVET ITEMS 1 AND 2 USING JIG FIXTURE 11430-203
7. FABRICATE PER CCP SPEC A0105-007
6. SILK SCREEN USING SSM 10353-502-3
5. FABRICATE USING PCM 10353-502-3
(1) 4. EPOXY GLASS LAMINATE WITH 2 OZ COPPER BOTH SIDES, MIL-P-13949C, TYPE GE
3. PLATING:
a - COPPER PLATE HOLES .001 MIN
b - NICKEL PLATE HOLES AND CIRCUITRY .00050 MIN.
c - GOLD PLATE HOLES AND CIRCUITRY .000050 MIN.
2. CHAMFER CONNECTOR TIP .020 X 30° BOTH SIDES.
1. BOARD THICKNESS AT CONNECTOR TIP NOT TO EXCEED .065 +.003 -.005
NOTE: UNLESS OTHERWISE SPECIFIED

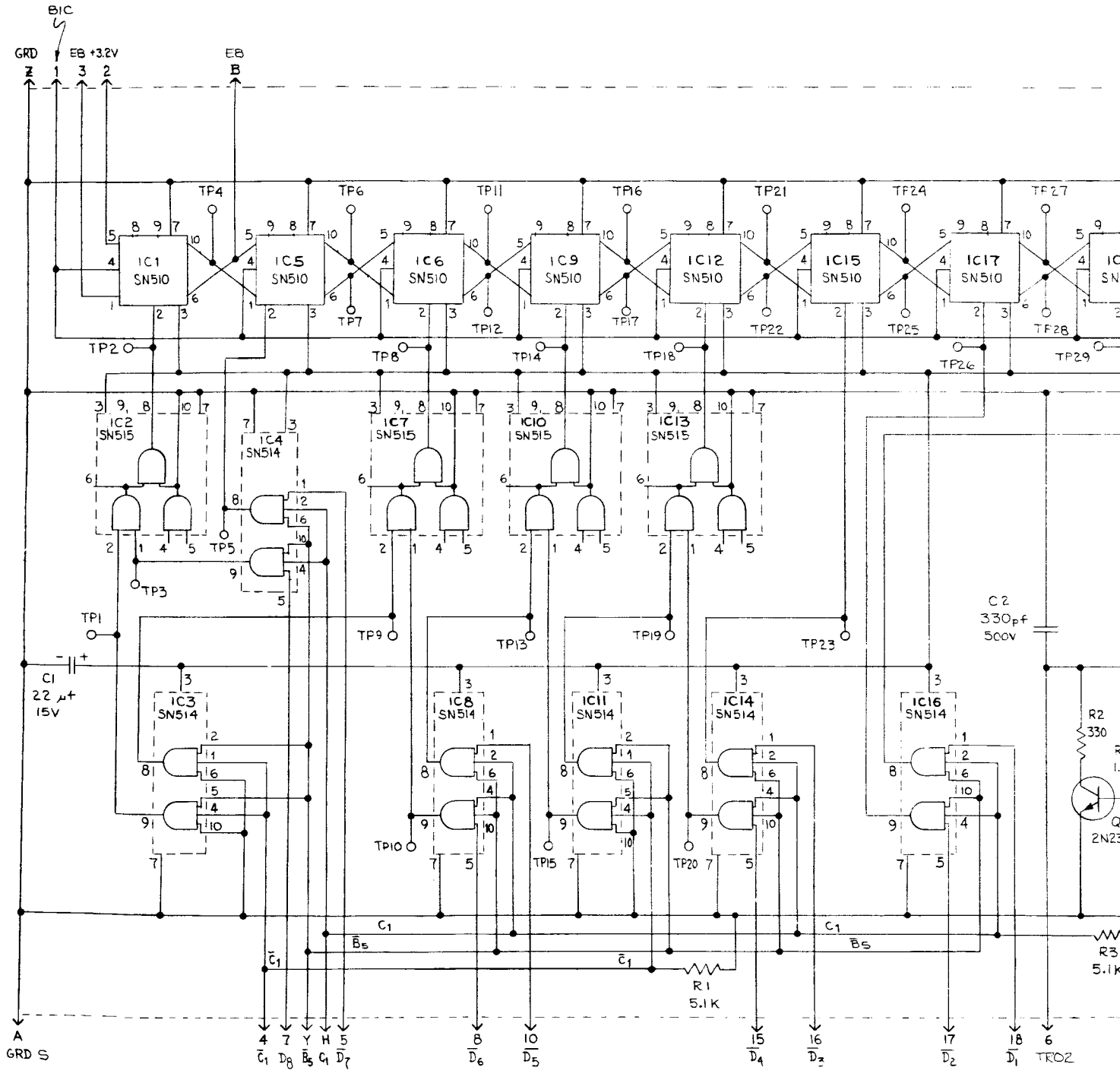
UNLESS OTHERWISE SPECIFIED	DRAWN	D. HAMPTON	28 MAY/66
DIMENSIONS ARE IN INCHES	CHECK		
TOLERANCES ON	APPD		
DECIMALS: .XX ± .03, .XXX ± .010 — ANGLES ± 0° 30'	APPD		
DRILLED HOLES: .040 TO .1285 +.002 −.001; .136 TO .228 +.003 −.001; .234 TO .500 +.004 −.001; .515 TO .750 +.005 −.001; .765 TO 1.000 +.007 −.001; 1.015 TO 2.000 +.010 −.001	FINISH		
	HEAT TREAT		
	SURFACE ROUGHNESS PER MIL-STD-10	✓	

CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

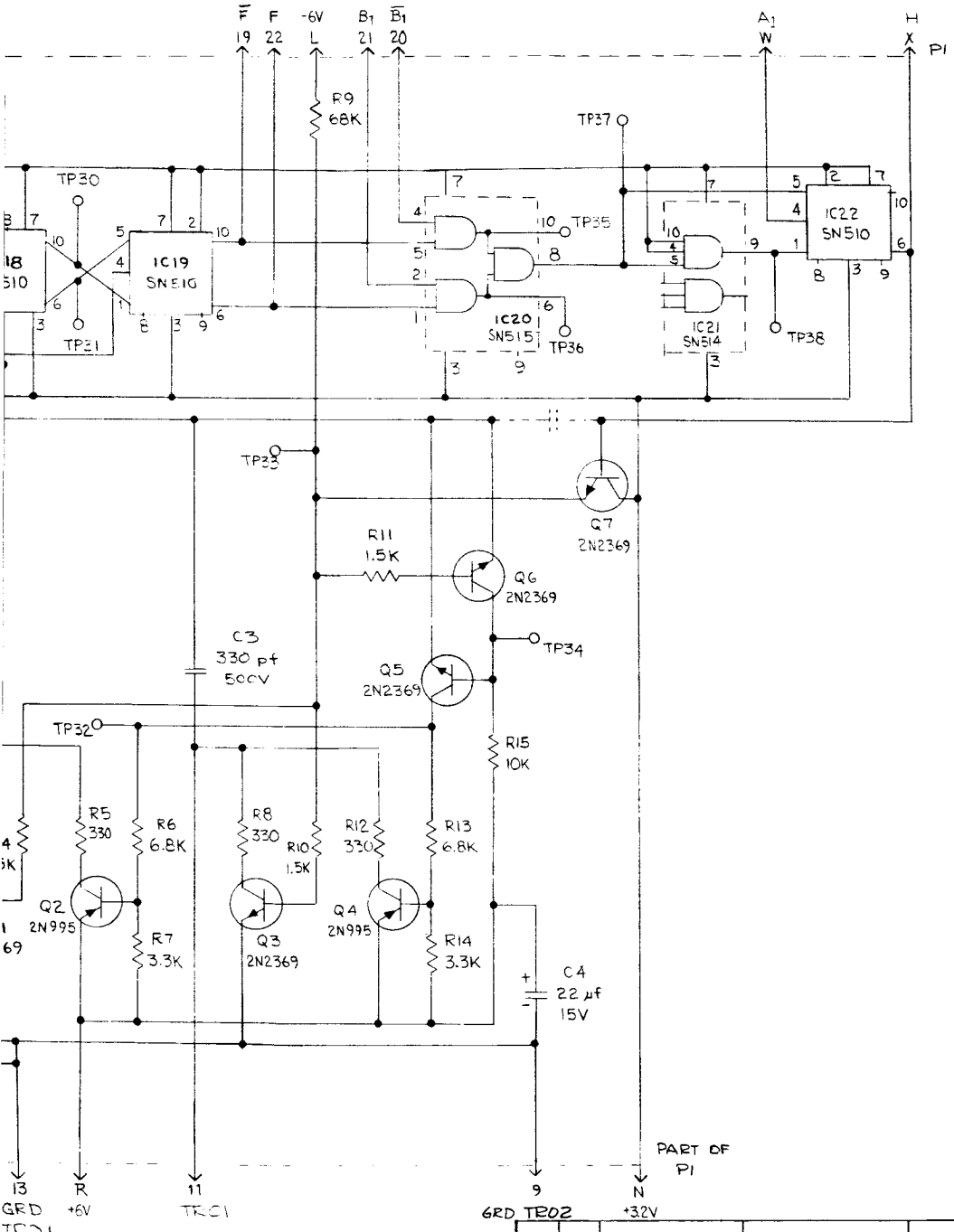
ENCODE TIMING GENERATOR

SCALE	SIZE	
2/1	F	10353-502
DO NOT SCALE THIS DRAWING	WEIGHT	SHEET

2


BIC
GRD
EB +3.2V
EB
Z
1
3
2
B
IC1 SN510
IC5 SN510
IC6 SN510
IC9 SN510
IC12 SN510
IC15 SN510
IC17 SN510
TP4
TP6
TP11
TP16
TP21
TP24
TP27
TP7
TP12
TP17
TP22
TP25
TP28
TP2
TP8
TP14
TP18
TP26
TP29
IC2 SN515
IC4 SN514
IC7 SN515
IC10 SN515
IC13 SN515
TP5
TP3
TP1
TP9
TP13
TP19
TP23
C1
22 µf
15V
C2
330pf
500V
IC3 SN514
IC8 SN514
IC11 SN514
IC14 SN514
IC16 SN514
TP10
TP15
TP20
R2
330
2N23
C1
B5
R1
5.1K
R3
5.1K
A
GRD S
4 C1
7 D8
Y B5
H C1
5 D7
8 D6
10 D5
15 D4
16 D3
17 D2
18 D1
6 TRO2

REVISIONS			
SYM	ZONE	DESCRIPTION	DATE & APPROVAL
		1 MAY BE REWORKED 2 CANNOT BE REWORKED 3 NONE	



REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION	ZONE

LIST OF MATERIAL OR PARTS LIST

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ±.03 .XXX ±.010
ANGLES ± 0° 30'
DRILLED HOLES
.040 TO .1285: +.002, —.001
.136 TO .228: +.003, —.001
.234 TO .500: +.004, —.001
.515 TO .750: +.005, —.001
.765 TO 1.000: +.007, —.001
1.015 TO 2.000: +.010, —.001

DRAWN	O. Hampton	20 Dec 65
CHECK	[illegible]	5-3-66
APPD		
APPD		
FINISH		
HEAT TREAT		
SURFACE ROUGHNESS PER MIL-STD-10	✓	

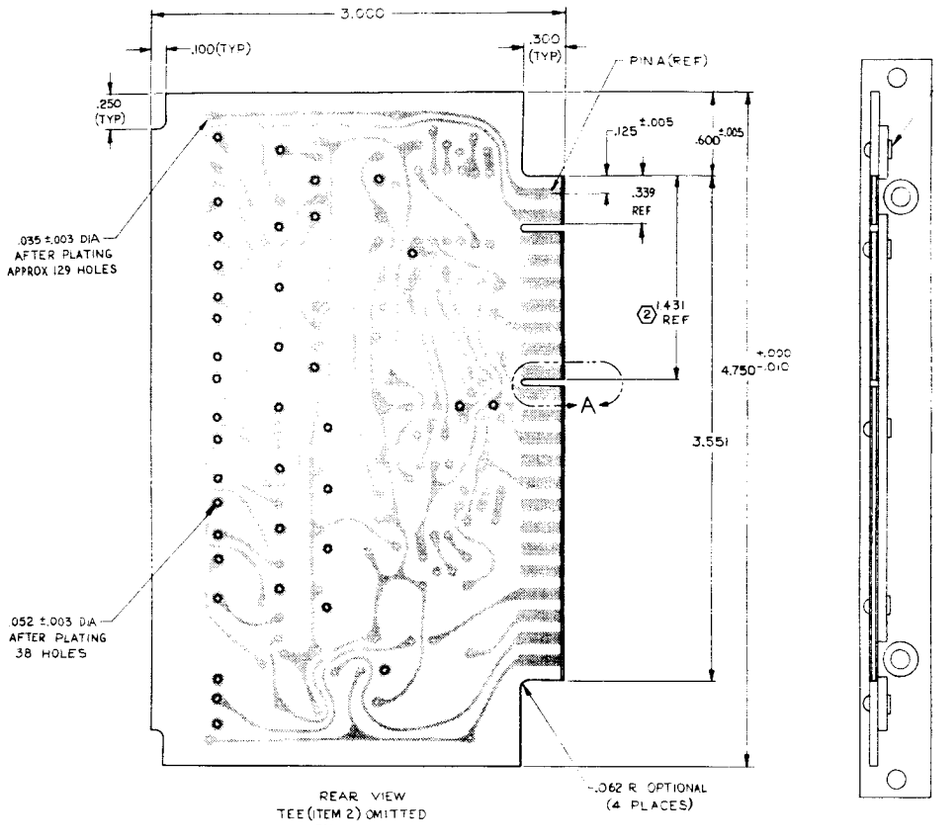
CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

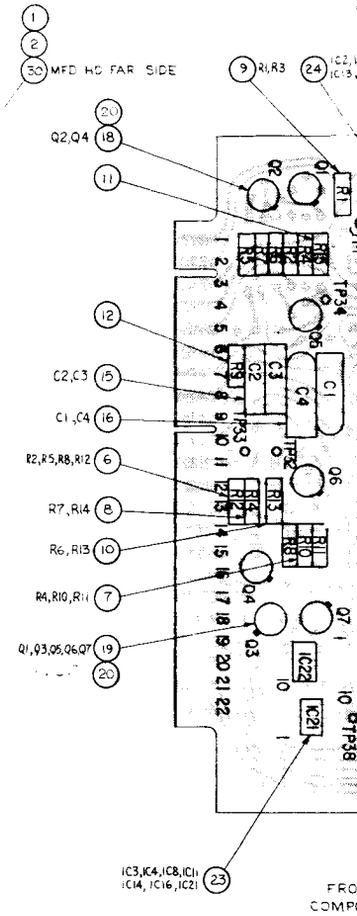
SCHEMATIC-
FRAME SYNC & DATA OUPT

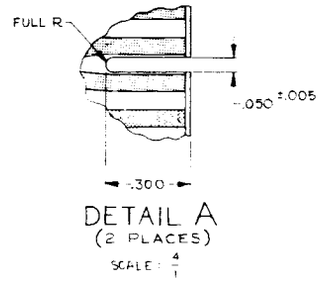
SCALE:	SIZE	
NONE	D	10354-502
DO NOT SCALE THIS DRAWING	WEIGHT	SHEET

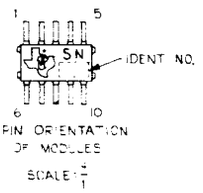
EF ASSY DWG NO [illegible]
ESISTOR VALUES ARE IN OHMS ± 2% AND ARE ¼W
E: UNLESS OTHERWISE SPECIFIED

2

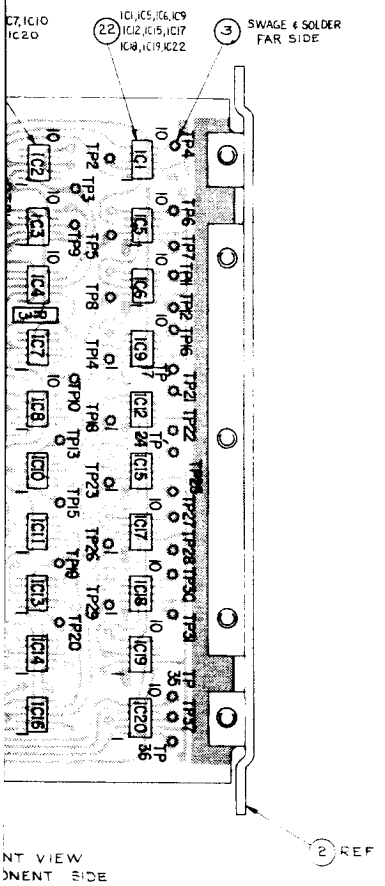

3.000
.100(TYP)
.300
(TYP)
.250
(TYP)
PIN A (REF)
.125 ±.005
.600 ±.005
.339
REF
.035 ±.003 DIA
AFTER PLATING
APPROX 129 HOLES
1.431
REF
4.750 +.000 -.010
A
3.551
.052 ±.003 DIA
AFTER PLATING
38 HOLES
.062 R OPTIONAL
(4 PLACES)
REAR VIEW
TEE (ITEM 2) OMITTED
FOR CLARITY


MFD HD FAR SIDE
R1,R3
Q2,Q4
Q2
R1
C2,C3
C1,C4
R2,R5,R8,R12
R7,R14
R6,R13
R4,R10,R11
Q1,Q3,Q5,Q6,Q7
Q4
Q3
IC23
IC21
TP34
TP33
TP32
C1
C2
C3
C4
R13
R14
R10
R11
IC3,IC4,IC8,IC11
IC14,IC16,IC21


FULL R
.050 ±.005
.300
DETAIL A
(2 PLACES)
SCALE: 4/1


1
5
SN
IDENT NO.
6
10
PIN ORIENTATION
OF MODULES
SCALE: 4/1

REVISIONS			
SYM	ZONE	DESCRIPTION	DATE & APPROVAL
		(1) MAY BE REWORKED (2) CANNOT BE REWORKED (3) NONE	



NT VIEW
ONENT SIDE

ITEM NO.	REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION			ZONE
30	5	MS20470A2-4	RIVET				
(4) 24	5	SN515	SOLID STATE MODULE WITH MYLAR INSULATOR			COML	
(4) 23	7	SN514	SOLID STATE MODULE WITH MYLAR INSULATOR			COML	
(4) 22	10	SN510	SOLID STATE MODULE WITH MYLAR INSULATOR			COML	
(7) 20	7	K-131	MOUNT TRANSISTOR			COML	
(6) 19	5	2N2369	TRANSISTOR			COML	
(6) 18	2	2N995	TRANSISTOR			COML	
(5) 16	2	KG22J15KM5	CAPACITOR	22μf ±10% 15V		COML	
(3) 15	2	CYFM15C331G	CAPACITOR	330pf ±2% 500V		COML	
(3) 12	1	C07	RESISTOR	68K ±2% 1/4W		COML	
11	1	↑	↑	10K ↑		↑	
10	2			6.8K			
9	2			5.1K			
8	2			3.3K			
7	3			1.5K			
(3) 6	4	C07	RESISTOR	330Ω ±2% 1/4W		COML	
3	38	9:0443-203	TERMINAL			DSCD	
2	1	11412-203-31	TEE-PCB ASSY				
1	1	10355-502-3	PCB	.062 +.006 -.004	(1)		
ITEM NO.	1	10355-502	FRAME SYNC & DATA OUPT				

LIST OF MATERIAL OR PARTS LIST

(7) 16. KIDWELL INC., VAN NUYS, CALIF
(6) 15. FAIRCHILD SEMICOND DIV., MOUNTAINVIEW, CALIF
(5) 14. KEMET DEPT UNION CARBIDE CORP., CLEVELAND, OHIO
(4) 13. TEXAS INSTRUMENTS INC, DALLAS, TEXAS
(3) 12. CORNING GLASS WORKS BRADFORD, PA
11. REF SCHEMATIC DWG NO. 10354-502
COMPONENT REF DESIGNATIONS ARE FOR LOCATING PURPOSES ONLY AND DO NOT APPEAR ON ACTUAL PART.
(2) 9. KEYSLOT DIMENSIONS ARE FOR REFERENCE ONLY, SLOT SHOULD BE CENTERED BETWEEN PINS AND MUST NOT TOUCH CIRCUITRY.
8. MATCH DRILL AND RIVET ITEMS 1 AND 2 USING JIG FIXTURE 11430-203
7. FABRICATE PER CCP SPEC A0105-007
6. SILK SCREEN USING SSM 10355-502-3
5. FABRICATE USING PCM 10355-502-3
(1) 4. EPOXY GLASS LAMINATE WITH 2 OZ COPPER BOTH SIDES, MIL-P-13949C, TYPE GF
3. PLATING:
a - COPPER PLATE HOLES .001 MIN
b - NICKEL PLATE HOLES AND CIRCUITRY .00050 MIN.
c - GOLD PLATE HOLES AND CIRCUITRY .000050 MIN.
2. CHAMFER CONNECTOR TIP .020 X 30° BOTH SIDES.
1. BOARD THICKNESS AT CONNECTOR TIP NOT TO EXCEED .065 +.003 -.009
NOTE: UNLESS OTHERWISE SPECIFIED

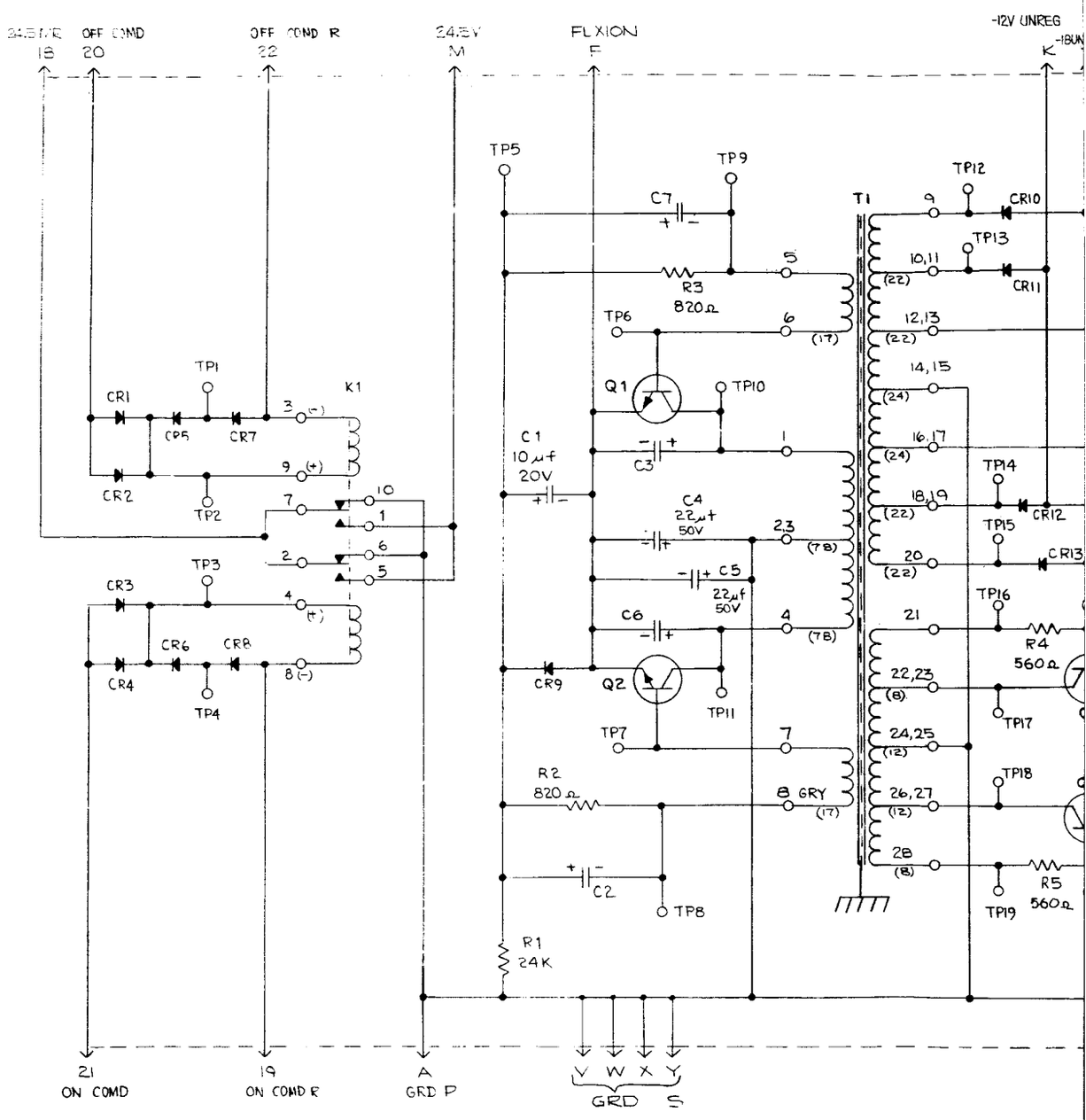
UNLESS OTHERWISE SPECIFIED	DRAWN	G. HAMPTON	28 MAY '74
DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS XX ± .03 XXX ± .010 ANGLES ± 0° 30'	CHECK		
	APPD		
	APPD		
DRILLED HOLES .040 TO .1285 +.002, -.001; .136 TO .228 +.003, -.001; .234 TO .500 +.004, -.001; .515 TO .750 +.005, -.001; .765 TO 1.000 +.007, -.001; 1.015 TO 2.000 +.010, -.001	FINISH		
	HEAT TREAT		
	SURFACE ROUGHNESS PER MIL-STD-10	✓	

CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

FRAME SYNC & DATA OUTPUT

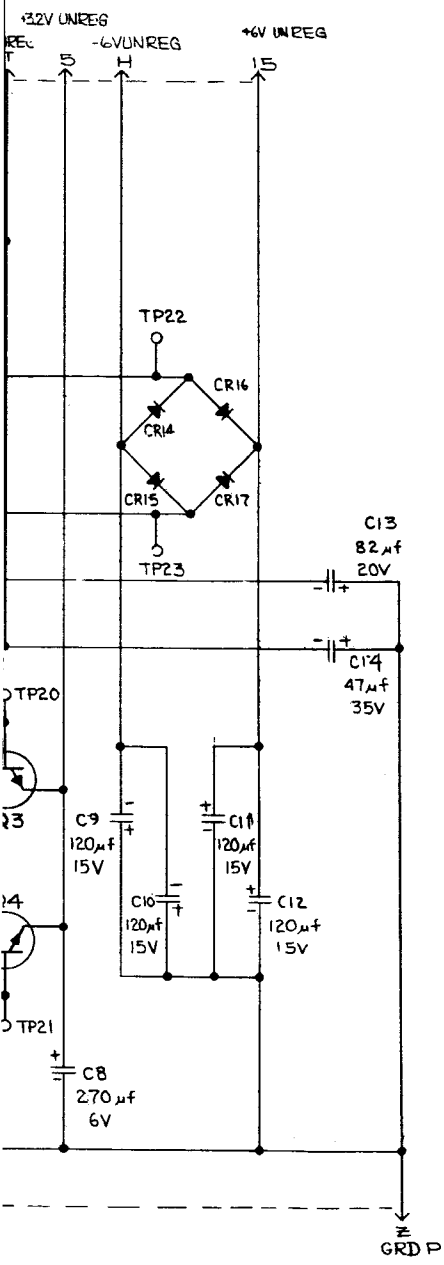
SCALE: 2/1	SIZE F	10355-502
DO NOT SCALE THIS DRAWING	WEIGHT	SHEET

2



5 RESISTOR VALUES ARE IN OHMS
4. REF ASSY DWG NO. 10370-5
3. CAPACITOR VALUES ARE IN MI
2. TRANSISTORS ARE 2N2658
1. DIODES ARE IN3730
NOTE: UNLESS OTHERWISE SPECIF

REVISIONS			
SYM	ZONE	DESCRIPTION	DATE & APPROVAL
		1 MAY BE REWORKED 2 CANNOT BE REWORKED 3 NONE	



ITEM	REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION	ZONE
	1	10369-502	SCHEMATIC		

LIST OF MATERIAL OR PARTS LIST

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03, .XXX ± .010
ANGLES: ± 0° 30'

DRILLED HOLES

.040	TO .1285	+.002, —.001
.136	TO .228	+.003, —.001
.234	TO .500	+.004, —.001
.515	TO .750	+.005, —.001
.765	TO 1.000	+.007, —.001
1.015	TO 2.000	+.010, —.001

DRAWN	O. HAMPTON	18 JAN, 1966
CHECK		5-3-66
APPD		
APPD		
FINISH		
HEAT TREAT		
SURFACE ROUGHNESS PER MIL-STD-10	✓	

CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

SCHEMATIC-
DC TO DC CONVERTER
NO. 1

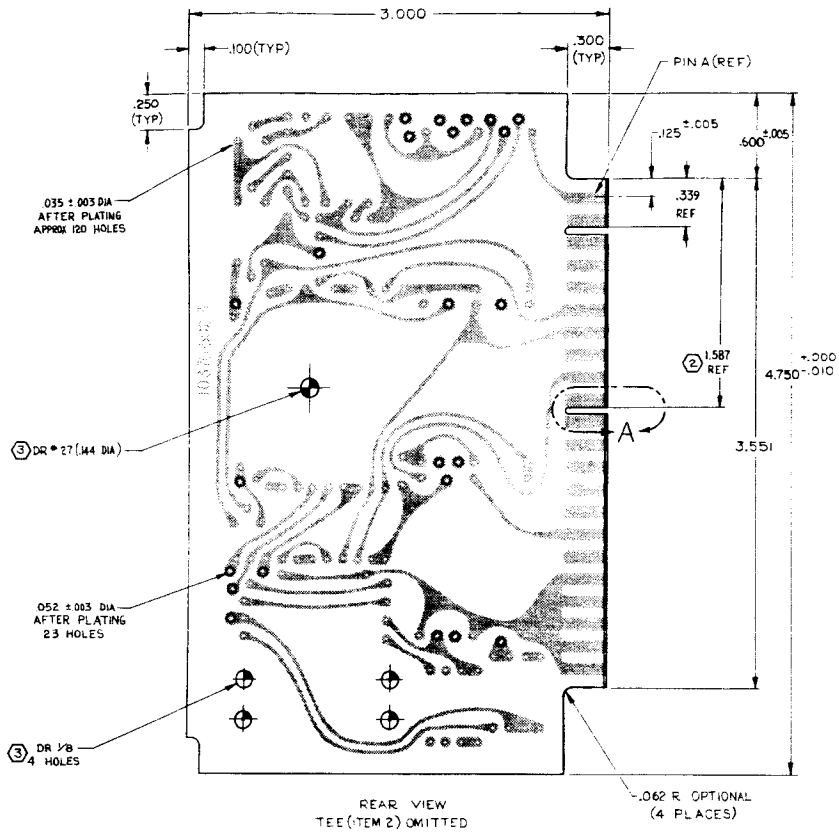
SCALE:	SIZE	
NONE	D	10369-502

DO NOT SCALE THIS DRAWING | WEIGHT | SHEET

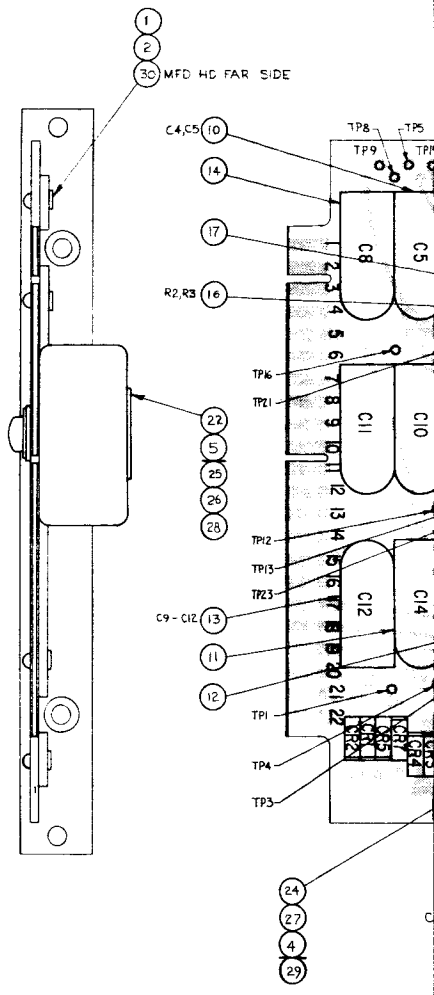
2% AND ARE 1/4W
)2
RO FARADS ±10%

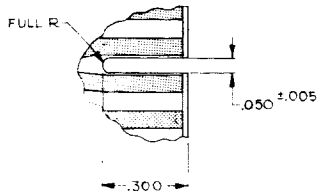
ED

2

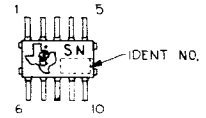


REAR VIEW
TEE (ITEM 2) OMITTED
FOR CLARITY



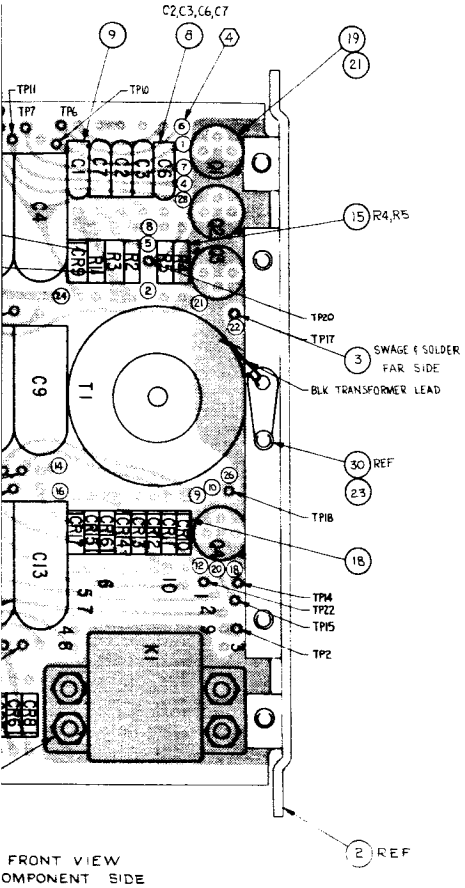


DETAIL A
(2 PLACES)
SCALE: 4/1



PIN ORIENTATION
OF MODULES
SCALE: 4/1

REVISIONS			
SYM	ZONE	DESCRIPTION	DATE & APPROVAL
		1 MAY BE REWORKED 2 CANNOT BE REWORKED 3 NONE	



FRONT VIEW
OMPONENT SIDE

ITEM NO.	REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION	ZONE
30	5	MS20470A2-4	RIVET		
29	4	MS35233-13	SCREW		
28	1	MS35233-31	SCREW		
27	4	MS35333-70	WASHER-LOCK		
26	1	MS35333-71	WASHER-LOCK		
25	1	AN960C6L	WASHER-FLAT		
24	4	AN340C4	NUT- HEX		
(11) 23	1	1485-6	LUG		COML
(10) 22	1	100-4	RETAINER-TOROID		COML
(9) 21	4	FP-50	MOUNT-TRANSISTOR	TO 5	COML
(8) 19	4	2N2658	TRANSISTOR	TO-5	COML
(7) 18	17	IN3730	DIODE		
(6) 17	1	C07	RESISTOR	24K ±2% ¼W	
(6) 16	2	C07	RESISTOR	820Ω ±2% ¼W	
(6) 15	2	C07	RESISTOR	560Ω ±2% ¼W	
(5) 14	1	KG270J6KMS	CAPACITOR	270μf ±10% 6V	
13	4	KG120J15KMS		120μf ±10% 15V	
12	1	KG82J20KMS		82μf ±10% 20V	
11	1	KG47J35KMS		47μf ±10% 35V	
10	2	KG22J50KMS		22μf ±10% 50V	
9	1	KG10J20KMS		10μf ±10% 20V	
(5) 8	4	KGR022J50KMS	CAPACITOR	.022μf ±10% 50V	COML
5	1	910005-403	TRANSFORMER		DSCD
4	1	11508-203	RELAY		
3	23	9.0443-203	TERMINAL		DSCD
2	1	11412-203-61	TEE-PCB ASSY		
1	1	10370-502-3	PCB	.062 G10 NEMA	

LIST OF MATERIAL OR PARTS LIST

(11) 20 HERMAN H SMITH CO, BROOKLYN, N.Y
(10) 19 MODULAR ELECTRONICS, INGLEWOOD, CALIF
(9) 18 DELBERT BLINN CO INC, POMONA, CALIF
(8) 17 HONEYWELL SEMI COND DIV, RIVIERA BEACH, FLA
(7) 16 RAYTHEON CO SEMI COND D.V., NEEDHAM HEIGHTS, MASS
(6) 15 CORNING GLASS WORKS, BRADFORD, PA
(5) 14 KEMET DEPT UNION CARBIDE CORP CLEVELAND, OHIO
(4) 13 TRANSFORMER LEADS TO BE SOLDERED AT PLACES INDICATED
(3) 12. DO NOT PLATE THRU
1. REF SCHEMATIC DWG NO. 10369-502
2. COMPONENT REF DESIGNATIONS ARE FOR LOCATING PURPOSES ONLY AND DO NOT APPEAR ON ACTUAL PART.
(2) 9. KEYSLOT DIMENSIONS ARE FOR REFERENCE ONLY. SLOT SHOULD BE CENTERED BETWEEN PINS AND MUST NOT TOUCH CIRCUITRY.
8. MATCH DRILL AND RIVET ITEMS 1 AND 2 USING JIG FIXTURE 11450-203
7. FABRICATE PER CPP SPEC A0105-007
6. SILK SCREEN USING SEMI 10370-502-3
5. FABRICATE USING PCM 10370-502-3
(1) 4. EPOXY GLASS LAMINATE WITH 2 OZ COPPER BOTH SIDES, MIL-P-13949D, TYPE GF
3. PLATING:
a - COPPER PLATE HOLES .001 MIN
b - NICKEL PLATE HOLES AND CIRCUITRY .00050 MIN.
c - GOLD PLATE HOLES AND CIRCUITRY .00050 MIN.
2. CHAMFER CONNECTOR TIP .020 x 30° BOTH SIDES. +.005 -.000
1. BOARD THICKNESS AT CONNECTOR TIP NOT TO EXCEED .065 +.005 -.008
NOTE UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: XX ± .03, XXX ± .010
ANGLES ± 0° 30'
DRILLED HOLES
.040 TO .128: + .002, — .001
.136 TO .228: + .003, — .001
.234 TO .500: + .004, — .001
.515 TO .750: + .005, — .001
.765 TO 1.000: + .007, — .001
1.015 TO 2.000: + .010, — .001

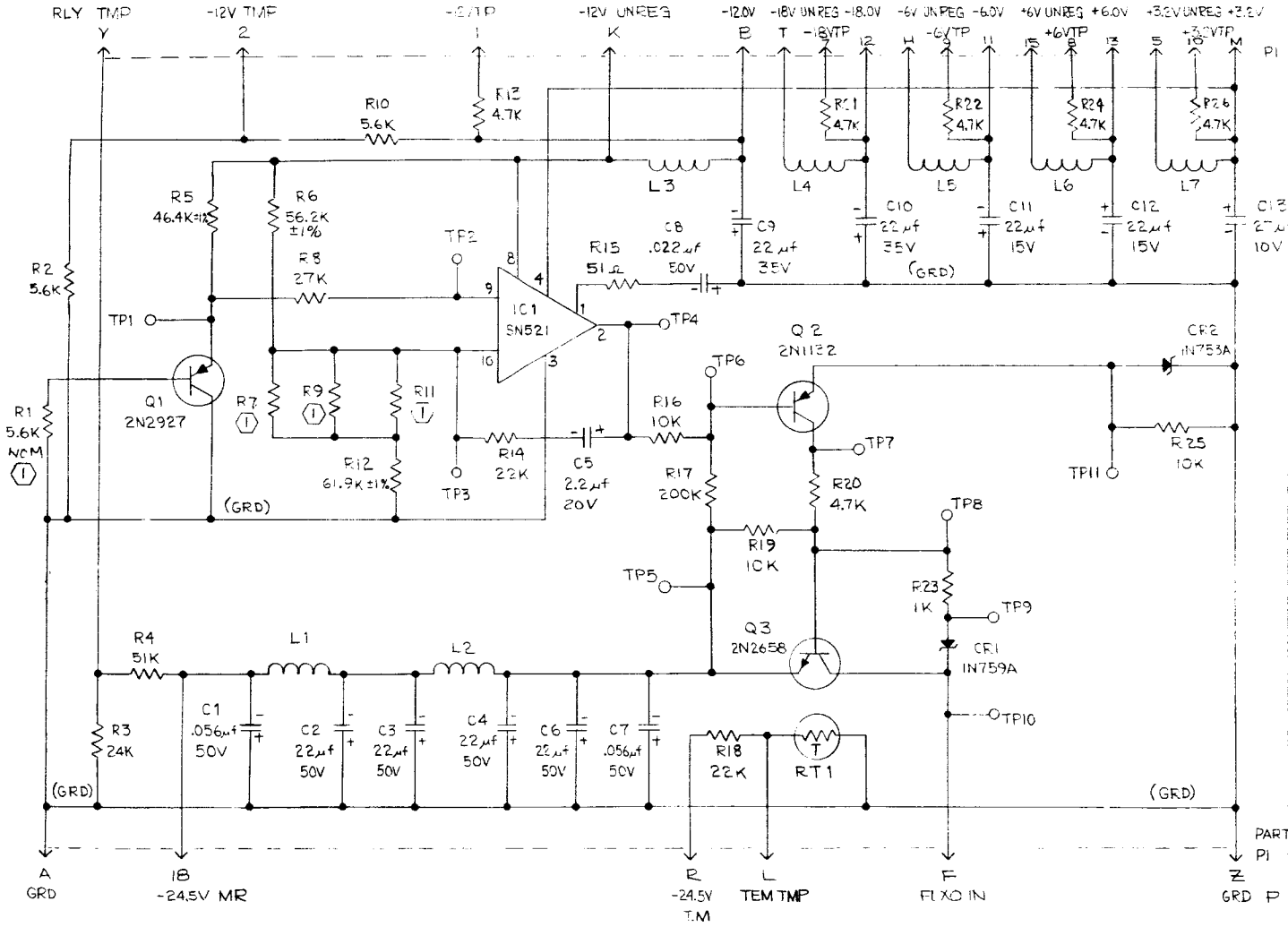
DRAWN D. HAMPTON 8 MAY 70
CHECK
APPD
APPD
FINISH
HEAT TREAT
SURFACE ROUGHNESS PER MIL-STD-10 ✓

CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

DC/DC CONVERTER NO. 1

SCALE: —
SIZE: F
10370-502
DO NOT SCALE THIS DRAWING
WEIGHT
SHEET

2



5. CAPACITOR
4. REF ASS
3. VALUE TO
2. CHOKES AR
1. RESISTOR
NOTE: UNLESS

REVISIONS				
SYM	ZONE	DESCRIPTION		DATE & APPROVAL
		[1] MAY BE REWORKED [2] CANNOT BE REWORKED [3] NONE	DISPO. / CLASS	

OF

REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION	ZONE
1	10372-502	SCHEMATIC		

LIST OF MATERIAL OR PARTS LIST

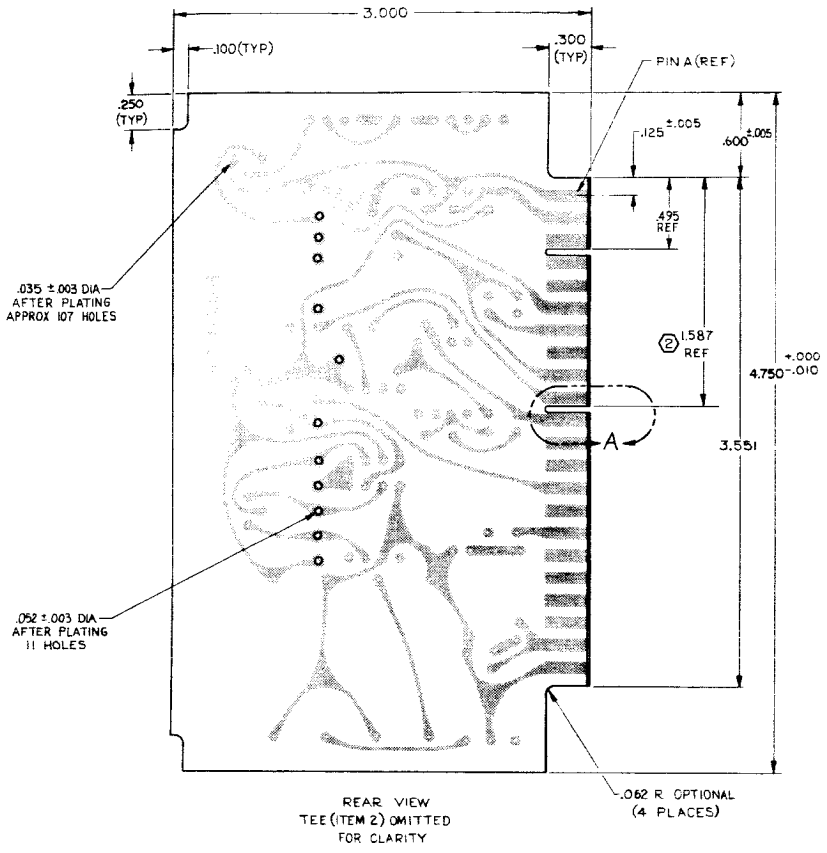
UNLESS OTHERWISE SPECIFIED			
DIMENSIONS ARE IN INCHES	DRAWN	C. HAYWARD	5 JAN 66
TOLERANCES ON	CHECK	[illegible]	5-3-66
DECIMALS .XX ± .03 .XXX ± .010 / ANGLES ± 0° 30'	APPD		
	APPD		
DRILLED HOLES	FINISH		
.040 TO .1285: +.002, —.001			
.136 TO .228: +.003, —.001			
.234 TO .500: +.004, —.001	HEAT TREAT		
.515 TO .750: +.005, —.001			
.765 TO 1.000: +.007, —.001			
1.015 TO 2.000: +.010, —.001	SURFACE ROUGHNESS PER MIL-STD-10	✓	

CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

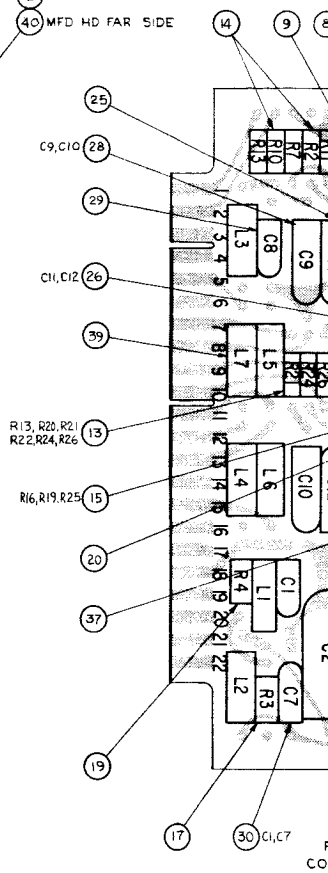
SCHEMATIC -
DC TO DC CONVERTER
NO. 2

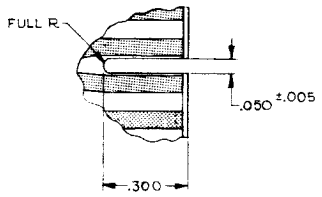
SCALE:	SIZE	
NONE	D	10372-502
DO NOT SCALE THIS DRAWING	WEIGHT	SHEET

R VALUES ARE IN MICRO FARADS ± 10%
Y DWG NO. 10371-502
BE DETERMINED AT FUNCTIONAL TEST
E TYPE 9320-30, 10 mA
VALUES ARE IN OHMS ±2% AND ARE 1/4W
OTHERWISE SPECIFIED

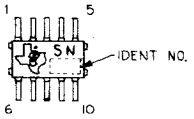


REAR VIEW
TEE (ITEM 2) OMITTED
FOR CLARITY



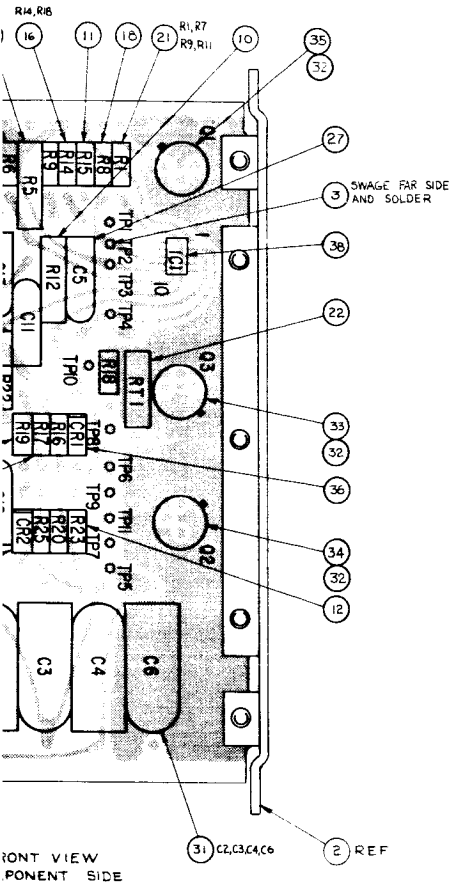


DETAIL A
(2 PLACES)
SCALE: 4/1



PIN ORIENTATION
OF MODULES
SCALE: 4/1

REVISIONS			
SYM	ZONE	DESCRIPTION	DATE & APPROVAL
		1 MAY BE REWORKED 2 CANNOT BE REWORKED 3 NONE	



RONT VIEW
PONENT SIDE

ITEM NO.	REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION			ZONE
40	5	MS20470A2-4	RIVET				
39	7	9320-30	CHOKE	10μh ±10%		COML	
38	1	SN521	SOLID STATE MODULE WITH MYLAR INSULATOR				
37	1	IN753A	DIODE ZENER				
36	1	IN759A	DIODE ZENER				
35	1	2N2927	TRANSISTOR				
34	1	2N1132	TRANSISTOR				
33	1	2N2658	TRANSISTOR			COML	
32	3	FP-50	MOUNT-TRANSISTOR			COML	
31	4	KG22J50KMS	CAPACITOR	22μf ±10% 50V		COML	
30	2	KGR056J50KMS		056μf ±10% 50V			
29	1	KGR022J50KMS		022μf ±10% 50V			
28	2	KG22J35KMS		22μf ±10% 35V			
27	1	KG2R2J20KMS		2.2μf ±10% 20V			
26	2	KG22J15KMS		22μf ±10% 15V			
25	1	KG27J10KMS	CAPACITOR	27μf ±10% 10V		COML	
22	1	TM-1/8	SENSISTOR	2.2K ±5% 1/8W		COML	
21	4	C07	RESISTOR	3 ±2% 1/4W			
20	1			200K			
19	1			51K			
18	1			27K			
17	1			24K			
16	2			22K			
15	3			10K			
14	2			5.6K			
13	6			4.7K			
12	1			1K			
11	1	C07		51Ω ±2% 1/4W			
10	1	MEA-TO		61.9K ±1% 1/8W			
9	1	MEA-TO		56.2K ±1% 1/8W			
8	1	MEA-TO	RESISTOR	464K ±1% 1/8W		COML	
3	11	910443-203	TERMINAL			DSCD	
2	1	11412-203-71	TEE-PCB ASSY				
1	1	10371-502-3	PCB	.062×3.06×4.81	1		

LIST OF MATERIAL OR PARTS LIST

(13) 22. DELBERT BLINN CO INC, POMONA, CALIF
(12) 21. J.W MILLER CO. LOS ANGELES, CALIF
(11) 20. MOTOROLA SEMICOND PROD INC, PHOENIX, ARIZ
(10) 19. SYLVANIA ELECTRIC PROD INC. WOBURN MASS
(9) 18. FAIRCHILD SEMICONDUCTOR DIV MOUNTAINVIEW, CALIF
(8) 17. HONEYWELL SEMICONDUCTOR DIV, RIVIERA BEACH, FLA
(7) 16. KEMET DEPT UNION CARBIDE CORP, CLEVELAND, OHIO
(6) 15. TEXAS INSTRUMENTS CORP; DALLAS TEXAS
(5) 14. CORNING GLASS WORKS; BRADFORD, PA.
(4) 13. INTERNATIONAL RESISTANCE CORP, PHILADELPHIA, PA.
(3) 12. VALUE TO BE DETERMINED AT FUNCTIONAL TEST
11. REF SCHEMATIC DWG NO. 10372-502
10. COMPONENT REF DESIGNATIONS ARE FOR LOCATING PURPOSES ONLY AND DO NOT APPEAR ON ACTUAL PART.
(2) 9. KEYSLOT DIMENSIONS ARE FOR REFERENCE ONLY, SLOT SHOULD BE CENTERED BETWEEN PINS AND MUST NOT TOUCH CIRCUITRY.
8. MATCH DRILL AND RIVET ITEMS 1 AND 2 USING JIG FIXTURE 11430-203
7. FABRICATE PER CCP SPEC A0105-007
6. SILK SCREEN USING SSM 10371-502-3
5. FABRICATE USING PCM 10371-502-3
(1) 4. EPOXY GLASS LAMINATE WITH 2 OZ COPPER BOTH SIDES, MIL-P-13949, TYPE GE
3. PLATING:
a - COPPER PLATE HOLES .001 MIN
b - NICKEL PLATE HOLES AND CIRCUITRY .00250 MIN.
c - GOLD PLATE HOLES AND CIRCUITRY .000050 MIN.
2. CHAMFER CONNECTOR TIP .020 X 30° BOTH SIDES.
1. BOARD THICKNESS AT CONNECTOR TIP NOT TO EXCEED .065 +.008 -.005
NOTE: UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED	DRAWN	C. HAMPTON	28 MAR 74
DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ± .03 .XXX ± .010 ANGLES ± 0° 30'	CHECK		
	APPD		
	APPD		
DRILLED HOLES .040 TO .1285 +.002, —.001; .136 TO .228 +.003, —.001; .234 TO .500 +.004, —.001; .515 TO .750 +.005, —.001; .765 TO 1.000 +.007, —.001; 1.015 TO 2.000 +.010, —.001	FINISH		
	HEAT TREAT		
	SURFACE ROUGHNESS PER MIL-STD-10	✓	

CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

DC/DC CONVERTER NO 2

SCALE: 2/1	SIZE F	10371-502
DO NOT SCALE THIS DRAWING	WEIGHT	SHEET

APPENDIX B

MRIR TELEMETRY UNIT

INPUT/OUTPUT

INTERFACE SPECIFICATION

Input Connector J1

Pin	Term	Characteristics
1	Spare	
2	-24.5 DRA	Connected to the negative terminal of the satellite primary regulated supply. To be used by the radiometer drive amplifiers.
3	----	Spare pin
4	OFFCMD	65-ms pulse with a nominal amplitude of +12 volts to the ON-OFF relay. Input impedance is 160 ohms. Relay is turned off.
5	OFFCMDR	Relay OFF command return line
6	----	Spare pin
7	GRD S	MRIR signal ground
8	GRD P	Power ground connected to the positive terminal of the satellite regulated supply.

Input Connector J1 (continued)

Pin	Term	Characteristics
9	-24.5 M	Connected to the negative terminal of the satellite primary regulated supply.
10	-24.5 TM	Connected to the negative terminal of the satellite primary regulated supply. To be used by the thermistor Input impedance is nominal 2K ohms.
11	ONCMD	65-ms pulse with a nominal amplitude of +12 volts to the ON-OFF relay. Input impedance is 160 ohms. Relay is turned on.
12	ONCMDR	Relay ON command return line.
13	----	Spare pin
14	GRD T	Telemetry ground
15	GRD C	Chassis ground

Output Connector J2

Pin	Term	Characteristics
1	TRO 1	Tape Recorder Output No. 1 amplitude is +6.5 volts to +5.0 volts for the high state and 0 volts ± 0.6 volts for the low state. Output impedance is 330 ohms.
2	----	Spare pin
3	GRD TRO 1	Tape Recorder Output No. 1 reference ground
4	GRD TRO 2	Tape Recorder Output No. 2 reference ground
5	GRD P	Power ground
6	TRO 2	Tape Recorder Output No. 2 characteristics are same as TRO 1, Pin 1.
7	GRD S	Signal ground
8	GRD T	Telemetry ground
9	GRD C	Chassis ground

Input/Output Connector J3

Pin	Term	Characteristics
1	-24.5 MR	Negative terminal of the satellite primary regulated supply. Primary power is routed through the MRIR unit to the radiometer.
2	-24.5 RDA	Negative terminal of the satellite primary regulated supply. Primary power is routed through the MRIR unit to the radiometer driver amplifier.
3	----	Spare pin
4	CH 1	Radiometer Analog Input No. 1 voltage amplitude is 0 volts to -6.4 volts at a frequency up to 8 cps. Input impedance is greater than 150K ohms when the analog gate is on.
5	CH 2	Radiometer Analog Input No. 2 (Same description as Pin 4.)
6	CH 3	Radiometer Analog Input No. 3 (Same description as Pin 4.)
7	GRD S	Signal ground

Input/Output Connector J3 (continued)

Pin	Term	Characteristics
8	GRD P	Power ground connected to positive terminal of the satellite primary regulated supply.
9	100 ØA	Output Phase A of a 2-phase, 100-cps, square wave signal which is routed through the MRIR unit to the radiometer. Amplitude is -1.5 ± 1.0 volt for the high level and -23.0 ± 1.5 volts for the low level.
10	100 ØB	Output Phase B of a 2-phase, 100-cps, square signal which is routed through the MRIR unit to the radiometer. Phase B leads Phase A by 90^{o}. Amplitude same as Phase B.
11	----	Spare
12	CH 4	Radiometer Analog Input No. 4 (Same description as Pin 4.)
13	CH 5	Radiometer Analog Input No. 5 (Same description as Pin 4.)
14	GRD T	Telemetry ground
15	GRD C	Chassis ground

Output Connector J4

Pin	Term	Characteristics
1	RLY TMP	Relay Telemetry Point Output. Voltage amplitude for on condition is 8 ± 1.5 volts and 0 ± 0.6 volts for the off condition. Output impedance is 16.3K ohms.
2	TEM TMP	Temperature Telemetry Point Output. Voltage amplitude is variable between -1.3 volts and -3.0 volts over the temperature range of $-10^{o}C$ to $+65^{o}C$. Output impedance is less than 3K ohms over the temperature range. The output voltage is derived from a separate -24.5 volt supply.
3	----	Spare
4	-18V TP	MRIR -18 volts ±3 percent regulated secondary supply. Provides 4.7K-ohm isolation resistor on output.
5	-12V TP	MRIR -12 volts ±3 percent regulated secondary supply. Provides 4.7K-ohm isolation resistor on output.

Output Connector J4 (continued)

Pin	Term	Characteristics
6	-6V TP	MRIR -6 volts ±3 percent regulated secondary supply. Provides a 4.7K-ohm isolation resistor on output.
7	+6V	MRIR +6 volts ±3 percent regulated secondary supply. Provides 4.7K-ohm isolation resistor on output.
8	+3.2V	MRIR +3.20 (+0.22V, -0.10V) regulator secondary supply. Provides a 4.7K-ohm isolation resistor on output.
9	----	Spare
10	RB4	208-cps symmetrical square wave output. Amplitude is +0.2 ± 0.1 volts for the 1 state and +2.0 ± 0.5 volts for the 0 state. Output impedance is greater than 4.7K ohms.
11	RB5	Pulse output that occurs every 4.8 milliseconds. Pulse duration for 1 state (+0.2 ± 0.1 volts) is 100 microseconds. For the remainder of the time, the 0 state is +2.0 ± 0.5 volts. Output impedance is greater than 4.7K ohms.

Output Connector J4 (continued)

Pin	Term	Characteristics
12	RB1	1.66-kc symmetrical square wave output. Amplitude for 1 state is +0.2 ± 0.1 volt and +2.0 ± 0.5 volts for the 0 state. Output impedance is greater than 4.7K ohms.
13	RN4 (ECD)	20-microsecond pulse output which repeats every 4.8 milliseconds. Output amplitude is +0.2 ± 0.1 volts for the 1 state and +2.0 ± 0.5 volts for the 0 state. Output impedance is greater than 4.7K ohms.
14	$\overline{RK4}$	25-kc symmetrical square wave output with an amplitude of +2.0 ± 0.5 volts for the high level and +0.2 ± 0.1 volts for the low level. The output impedance is greater than 4.7K ohms.

Output Connector J4 (continued)

Pin	Term	Characteristics
15	RC6	Pulse output that repeats 33 times per second pulse duration is 4.8 milliseconds. Voltage amplitude is +2.0 ± 0.5 volts for the 0 level and +0.2 ± 0.1 volts for the 1 level. The output impedance is greater than 4.7K ohms.
16	RC1	Pulse output which occurs 30 milliseconds after C6 occurs. The voltage amplitude and output impedance characteristics are the same as C6 on Pin 15.
17	CH5	Radiometer Analog Input No. 5. This pin is provided for a protective purpose. During shipping this point is shorted to signal ground.
18	GRD S	Signal ground

Output Connector J4 (continued)

Pin	Term	Characteristics
19	GRD P	Power ground connected to the positive terminal of the satellite primary regulated supply.
20	-12 TMP	-12 volt telemetry point output. Nominal voltage output is -6 volts ±4 percent. The output impedance is 2.8K ohm ±2 percent.
21	CH4	Radiometer Analog Input No. 5. Same description as Pin 17 on this connector.
22	$\overline{RD1}$	LSB from the A/D data register. Voltage amplitude is +2.0 ± 0.5 volts for the 0 state and +0.2 ± 0.1 volts for the 1 state. Output impedance is greater than 4.7K ohms. Digital value is 2^0.
23	$\overline{RD2}$	2^1 Digital bit from the A/D data register. Voltage and impedance characteristics are the same as $\overline{D1}$ on Pin 22.

Output Connector J4 (continued)

Pin	Term	Characteristics
24	$\overline{RD3}$	2^2 Digital bit from the A/D data register. Voltage and impedance characteristics are the same as $\overline{D1}$ on Pin 22.
25	$\overline{RD4}$	2^3 Digital bit from the A/D data register. Voltage and impedance characteristics are the same as $\overline{D1}$ on Pin 22.
26	$\overline{RD5}$	2^4 Digital bit from the A/D data register. Voltage and impedance characteristics are the same as $\overline{D1}$ on Pin 22.
27	$\overline{RD6}$	2^5 Digital bit from the A/D data register. Voltage and impedance characteristics are the same as $\overline{D1}$ on Pin 22.
28	$\overline{RD7}$	2^6 Digital bit from the A/D data register. Voltage and impedance characteristics are the same as $\overline{D1}$ on Pin 22.

Output Connector J4 (continued)

Pin	Term	Characteristics
29	RD8	2^7 Digital bit from the A/D data register. Voltage and impedance characteristics are the same as $\overline{D1}$ on Pin 22.
30	CH3	Radiometer Analog Input No. 3. Same description as Pin 17 on this connector.
31	COMP OT	Comparator output voltage. Voltage output swings from +3.0 volts for $V_{ladder} < V_{input}$ to -6.0 volts for $V_{ladder} > V_{input}$. Output impedance is greater than 4.7K ohms.
32	V PREC	Precision voltage output -10.0 ± 0.3 volts. Output impedance is greater than 4.7K ohms.
33	Spare	
34	CH2	Radiometer Analog Input No. 2. Same description as Pin 17 on this connector.

Output Connector J4 (continued)

Pin	Term	Characteristics
35	CH1	Radiometer Analog Input No. 1. Same description as Pin 17 on this connector.
36	GRD T	Telemetry ground
37	GRD C	Chassis ground

Input Connector J5

Pin	Term	Characteristics
1	10 KC CLK	10-kc symmetrical square wave input nominal voltage swing is 0 volts to -6 volts. Input impedance is 3.3K ±2 percent.
2	----	Spare
3	200 KC CLK	200-kc symmetrical square wave input. Nominal voltage swing is 0 volts to -6 volts. Input impedance is 24.7 ohms ±10 percent.
4	GRD 200 KC	Provided as 200-kc input reference ground.
5	GRD P	Power ground connected to the positive terminal of the satellite primary regulated supply.
6	100 ØA	Input Phase A, 100 cps, square wave to be used by the radiometer subsystem. Nominal voltage swing is same as J3, Pin 9.

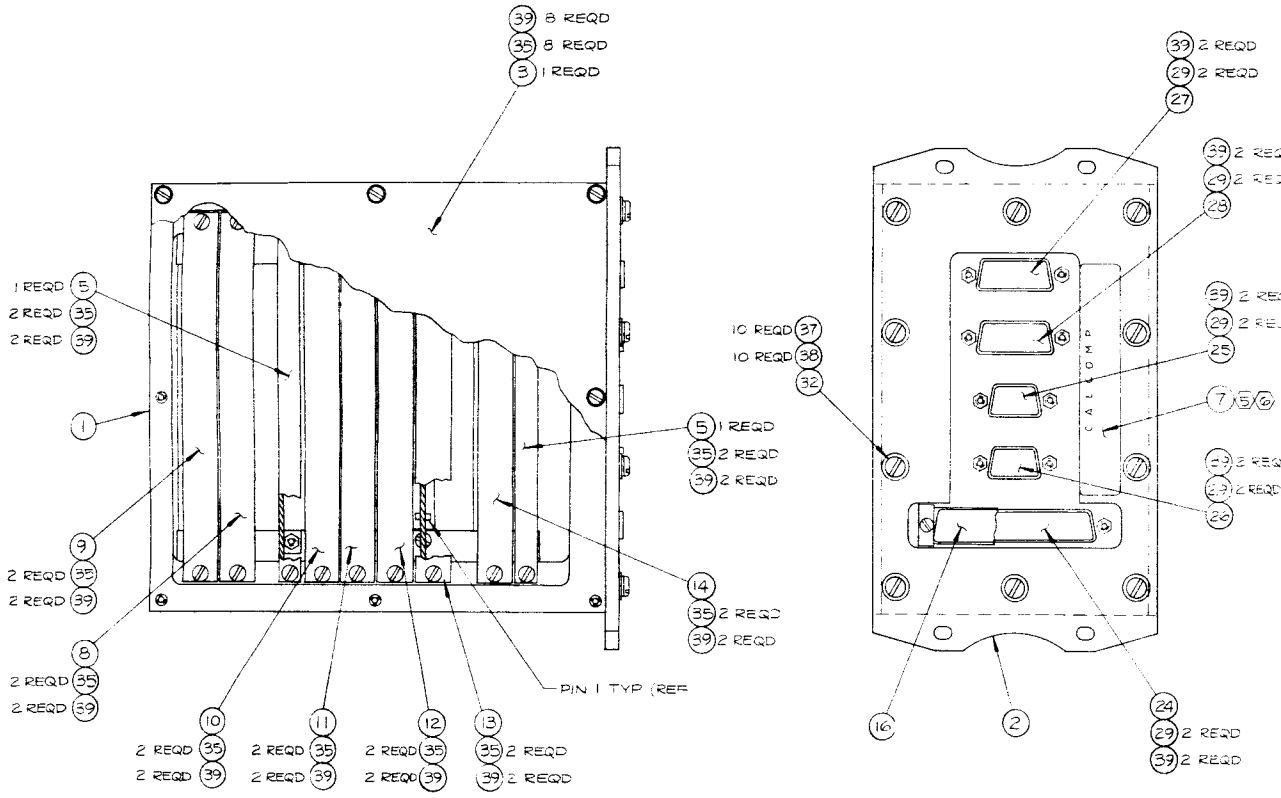
Input Connector J5 (continued)

Pin	Term	Characteristics
7	100 ØB	Input Phase B, 100 cps, square wave to be used by the Radiometer subsystem. Nominal voltage swing is same as J3, Pin 10. Phase B leads Phase A by 90^{o}.
8	----	Spare pin
9	GRD S	Signal ground

APPENDIX C

MRIR TELEMETRY UNIT

MECHANICAL DRAWINGS


39 8 REQD
35 8 REQD
3 1 REQD
1 REQD 5
2 REQD 35
2 REQD 39
1
9
2 REQD 35
2 REQD 39
8
2 REQD 35
2 REQD 39
5 1 REQD
35 2 REQD
39 2 REQD
14
35 2 REQD
39 2 REQD
PIN 1 TYP (REF
10
2 REQD 35
2 REQD 39
11
2 REQD 35
2 REQD 39
12
2 REQD 35
2 REQD 39
13
35 2 REQD
39 2 REQD
10 REQD 37
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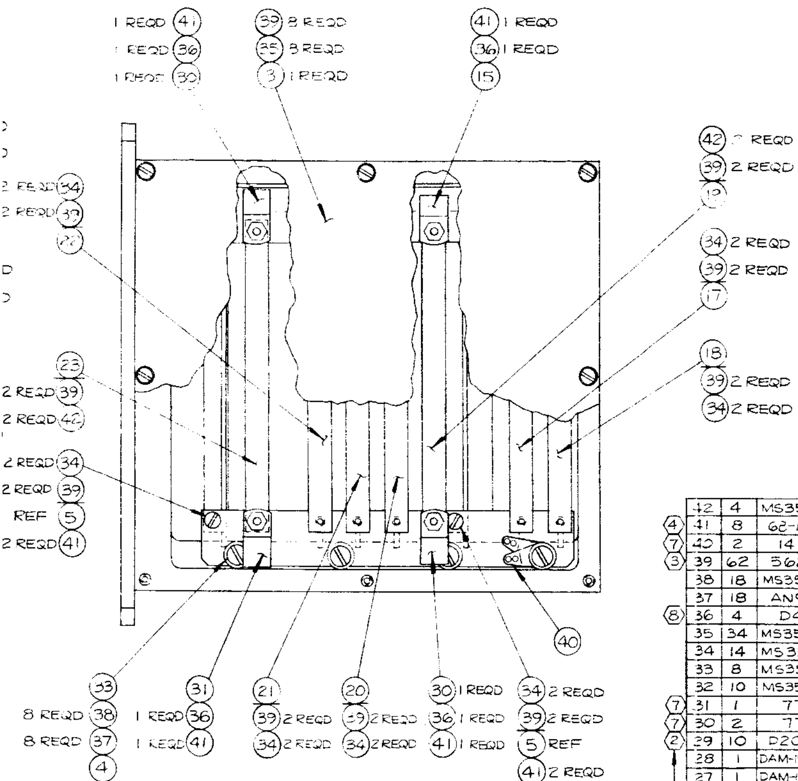
25
24
29 2 REQD
39 2 REQD
16
2
CALCOMP



SYM	ZONE	DESCRIPTION	DISPOS	CLASS	DATE & APPROVAL
		[1] MAY BE REWORKED [2] CANNOT BE REWORKED [3] NONE			
A		1. IN L/M: DAM-15P CONN. WAS DBM-15P; DAM-15S CONN. WAS DBM-15S	3		E.O. 1356
		2. IN L/M & F/D ADDED: TERM. LUG #1416-6, 2 REQD	1		HENEGAR 4-20-66
		3. IN L/M & F/D ADDED: "D" WASHER #D4-140, 4 REQD; CABLE CLAMP #775, 1 REQD; CABLE CLAMP #773 2 REQD; CABLE CLAMP #771, 1 REQD; PLUG-JUMPER #11507-203, 1 REQD; SCREW, PAN HD #MS35233-18, 4 REQD	1		
		4. IN L/M: NUT, SELF-LOCKING #68-1660-40, 5 REQD WAS 4 REQD; SCREW, PAN HD #MS35233-15, 14 REQD WAS 18 REQD	1		
		5. ADDED G/NS #10 & 11			
		EFFECT ON: ITEMS 1, 3, 4 & 5 = UNIT 2 & SUBS; ITEM 2 = ALL PARTS			

NOTE	ITEM NO	REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION	ZONE
	42	4	MS35233-18	SCREW, PAN HD.	4-40×5/8	
4	41	8	62-1660-40	NUT, SELF-LOCKING	4-40	
7	40	2	1416-6	TERM. LUG		
3	39	62	5622-9	WASHER, MYLAR	#4	
	38	18	MS35337-79	L'WASHER, SPLIT	#6	
	37	18	AN960C6	WASHER, FLAT	#6	
8	36	4	D4-140	"D" WASHER		
	35	34	MS35233-13	SCREW, PAN HD.	4-40×1/4	
	34	14	MS35233-15	SCREW, PAN HD.	4-40×3/8	
	33	8	MS35233-28	SCREW, PAN HD.	6-32×3/8	
	32	10	MS35233-29	SCREW, PAN HD	6-32×7/16	
7	31	1	775	CABLE CLAMP		
7	30	2	773	CABLE CLAMP		
2	29	10	D20418-10	SCREW LOCK		
	28	1	DAM-15P-NMB-1	CONNECTOR		
	27	1	DAM-15S-NMB-1			
	26	1	DEM-9P-NMB-1			
	25	1	DEM-9S-NMB-1			
2	24	1	DCM-37S-NMB-1	CONNECTOR		
1	23	1	BR-22-DRX1-23-56	CONNECTOR-PCB		
	22	1	-23-67			
	21	1	-23-78			
	20	1	-23-89			
	19	1	-23-910			
	18	1	-34-1011			
1	17	1	BR-22-DRX1-23-1011	CONNECTOR-PCB		
	16	1	11507-203	PLUG-JUMPER		
7	15	1	771	CABLE CLAMP		
	14	1	10351-502	ANALOG IN. & 25KC		
	13	1	10367-502	A/D CONVERTER		
	12	1	10365-502	A/D DATA CONTROL		
	11	1	10353-502	ENCODE TIMING GEN		
	10	1	10355-502	FRAME SYNC & D. OUT.		
	9	1	10371-502	DC/DC CONVERT. #2		
	8	1	10370-502	DC/DC CONVERT. #1		
5	7	1	11429-203	NAMEPLATE		
	6	1	W/L 10015-102	WIRE LIST		
	5	2	11414-203	SHIELD-P.C.B.		
	4	2	11416-203	PLATE-MTG., CONN.		
	3	2	11415-203	COVER, HOUSING		
	2	1	11411-203	CONN. PLATE		
	1	1	11413-203	HOUSING, P.C.B.		
	ITEM	1	10015-102	MRIR-PCM		

LIST OF MATERIAL OR PARTS LIST

(6) 11. ... CO., INC., CHICAGO, ILL.
(7) 10. H.H. SMITH ... BROOKLYN, N.Y.
9. ALL THREADED FASTENERS WILL BE TORQUED TO THE FOLLOWING VALUES:
#4 FASTENER = 5.2 INCH POUNDS
#6 FASTENER = ... INCH POUNDS
(6) 8. ... IN PLACE ... WHERE SHOWN
(5) 7. ELECTROETCH ... HIGH CHARACTERS:
NAME: ...
PART NO. ... (AS REQD)
6. INSTALL ALL HARDWARE WITH LOCTITE, GRADE A; LOCTITE CORP. NEWINGTON, CONN.
5. WIRE PER W/L 10015-102
(4) 4. ELASTIC STOP NUT CORP., UNION, N.J.
(3) 3. SEASTROM ... GLENDALE, CALIF.
(2) 2. CANNON ELECTRIC, LOS ANGELES, CALIF.
(1) 1. MASTERITE INDUSTRIES, INGLEWOOD, CALIF.

NOTE: UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED	DRAWN	B. HENEGAR	1-27-66
DIMENSIONS ARE IN INCHES TOLERANCES ON	CHECK	[signature]	2-1-66
DECIMALS .XX ± .03 .XXX ± .010 / ANGLES ± 0° 30'	APPD	[signature]	2-1-66
	APPD	[signature]	2-2-66

DRILLED HOLES
.040 TO .1285: + .002, — .001
.136 TO .228: + .003, — .001
.234 TO .500: + .004, — .001
.515 TO .750: + .005, — .001
.765 TO 1.000: + .007, — .001
1.015 TO 2.000: + .010, — .001

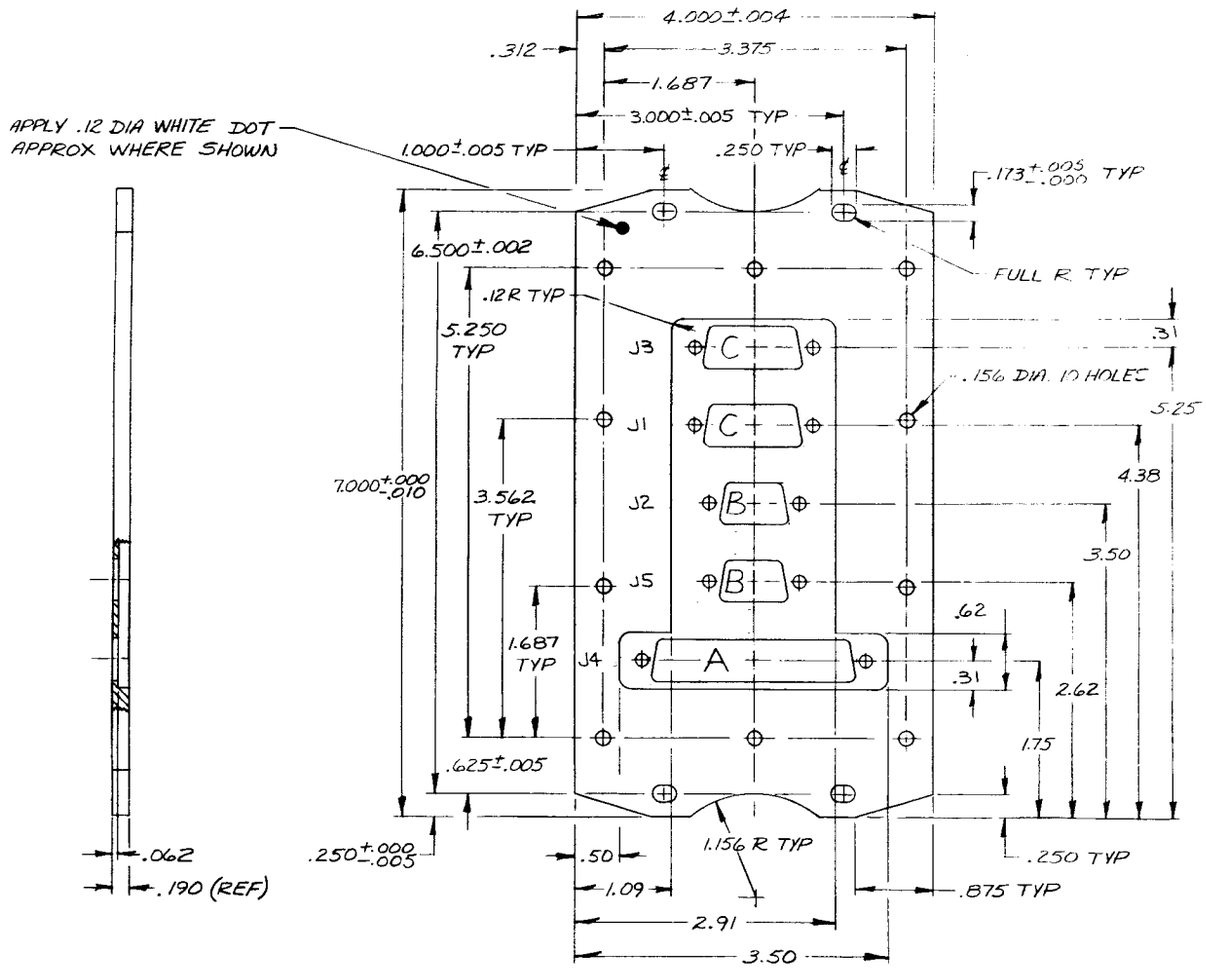
FINISH
HEAT TREAT
SURFACE ROUGHNESS PER MIL-STD-10 ✓

CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

MRIR-PCM DIGITAL SUB-SYSTEM

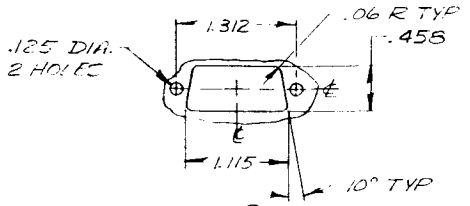
SCALE: 1/1 | SIZE F | 10015-102
DO NOT SCALE THIS DRAWING
WEIGHT | SHEET 1 OF 1

2

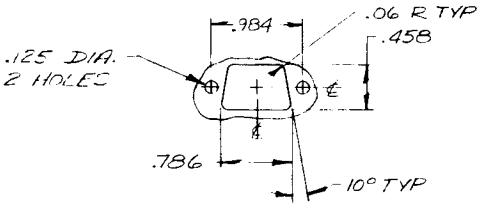


5. TAB WITH PART NO. AND
4. ALL MACHINED SU
3. DOWEL # PER MIL M
2. RUBBER STAMP DES
SHOWN
1. MACHINE PER CCP SP
NOTE: UNLESS OTHERW

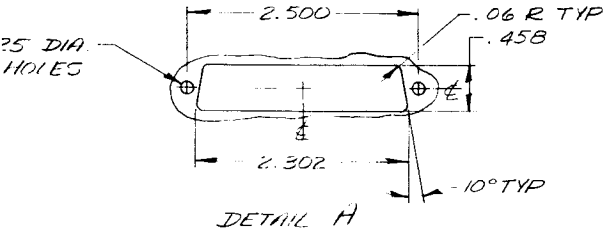
REVISIONS			
SYM	ZONE	DESCRIPTION	DATE & APPROVAL
		1 MAY BE REWORKED 2 CANNOT BE REWORKED 3 NONE	DISPOS CLASS



DETAIL C TYP 2 PLACES



DETAIL B TYP 2 PLACES



DETAIL A

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION	ZONE
1	11411-203	CONN. PLATE	.190 × 4.06 × 7.06 AR31B-HPG MAT'L PER MIL-A-	

LIST OF MATERIAL OR PARTS LIST

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: XX ± .03, XXX ± .010
ANGLES: ± 0° 30'

DRILLED HOLES

.040	TO .1285	+ .002, — .001
.136	TO .228	+ .003, — .001
.234	TO .500	+ .004, — .001
.515	TO .750	+ .005, — .001
.765	TO 1.000	+ .007, — .001
1.015	TO 2.000	+ .010, — .001

DRAWN	D. MILLER	12-28-65
CHECK	[illegible]	1-21-66
APPD	[illegible]	2-1-66
APPD	[illegible]	2-1-66

FINISH (1)

HEAT TREAT

SURFACE ROUGHNESS PER MIL-STD-10 ✓

CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

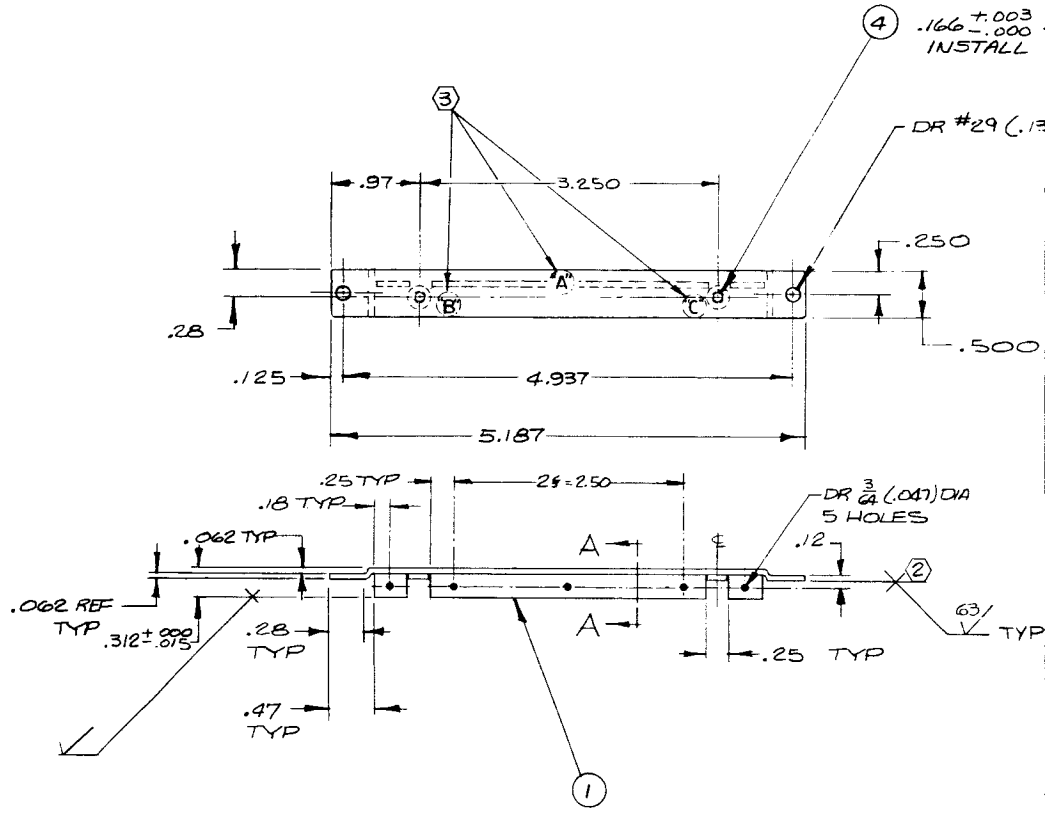
CONN. PLATE
11411-203

SCALE: FULL
SIZE: D
WEIGHT
SHEET 1 OF 2
DO NOT SCALE THIS DRAWING

[illegible] SPEC MIL-C-[illegible]
REPLATES
[illegible] TYPE I, CLASS C
[illegible]. APPROX WHERE
[illegible] CONFORMING BLACK INK.
EC MICRO-CIRCUIT
ISE SPECIFIED

2

DASH NO	"A" (3)	"B" (3)	"C" (3)
-11	ANALOG INPUTS & 25KC	ASSY NO 10351-502	SERIAL NO (4)
-21	ENCODE-TIMING	ASSY NO 10353-502	SERIAL NO (4)
-31	FRAME SYNC & OUTPUT	ASSY NO 10355-502	SERIAL NO (4)
-41	A/D DATA CONTROL	ASSY NO 10365-502	SERIAL NO (4)
-51	A/D CONVERTER	ASSY NO 10367-502	SERIAL NO (4)
-61	DC/DC CONVERTER #1	ASSY NO 10370-502	SERIAL NO (4)
-71	DC/DC CONVERTER #2	ASSY NO 10371-502	SERIAL NO (4)



(6) 10. PENN ENG'G & MFG CO.

(5) 9. MAKE FROM PA 6/6 C
PIONEER ALUM. LOS A

8.

(4) 7. TO BE ASSIGNED

(3) 6. ELECTRO-ETCH DESIG
WHERE SHOWN USING .
5. ±.5/ ALL MACHINE SURFACE

(2) 4. NORMAL WITHIN .005 N/
3. BREAK SHARP EDGES .0

(1) 2. CAUSTIC DIP AFTER
1. MACHINE PER CCP SPEC

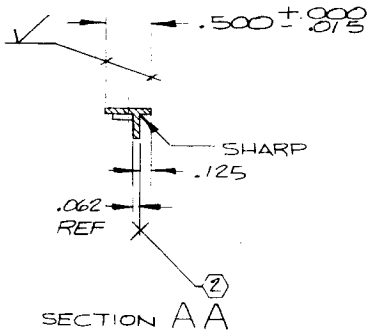
NOTE: UNLESS OTHERWISE

REVISIONS			
SYM	ZONE	DESCRIPTION	DATE & APPROVAL
		1 MAY BE REWORKED 2 CANNOT BE REWORKED 3 NONE	DESIGN / CLASS
A		1. IN TAB BLOCK; -61 DC/DC CONV. #1 WAS POWER SUPPLY #1, -71 DC/DC CONV. #2 WAS POWER SUPPLY #2 -61 DC/DC CONV #1, ASSY NO 10370-502 WAS 10369-502 (EO 1341) EFFECT ON: UNIT #2 & SUBS	ARC 4-21-66

DIA 2 HOLES
FARSIDE

6) 2 HOLES

REF



ITEM NO	-71	-61	-51	-41	-31	-21	-11	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION			ZONE
6	4	2	2	2	2	2	2	CLS-440-2	NUT, CLINCH			COML	
5	1	1	1	1	1	1	1	11412-203-1	TEE	5	5	COM'L	
	1	1	1	1	1	1	1	11412-203	TEE, P.C.B.			COM'L	

LIST OF MATERIAL OR PARTS LIST

, DOYLESTOWN, PA.

X 5.25, CCE-TS AL ALY EXT.
SELES, CALIFORNIA.

TIONS APPROX
HIGH CHARACTERS.
.
1. TYP BOTH ENDS.
D-.015.
ELECTRO-ETCHING.
40102-001.
SPECIFIED

UNLESS OTHERWISE SPECIFIED			
DRAWN	A.R COLL	12-29-65	CALIFORNIA COMPUTER PRODUCTS INC.
CHECK	E. Hansen	1-21-66	305 MULLER, ANAHEIM, CALIFORNIA
APPD	E. Gilbert	2-1-66	
APPD	J. Pratt	2-1-66	TEE-P.C.B. ASSY

DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ±.03, .XXX ±.010
ANGLES: ±0° 30'

DRILLED HOLES
.040 TO .1285: +.002, —.001
.136 TO .228: +.003, —.001
.234 TO .500: +.004, —.001
.515 TO .750: +.005, —.001
.765 TO 1.000: +.007, —.001
1.015 TO 2.000: +.010, —.001

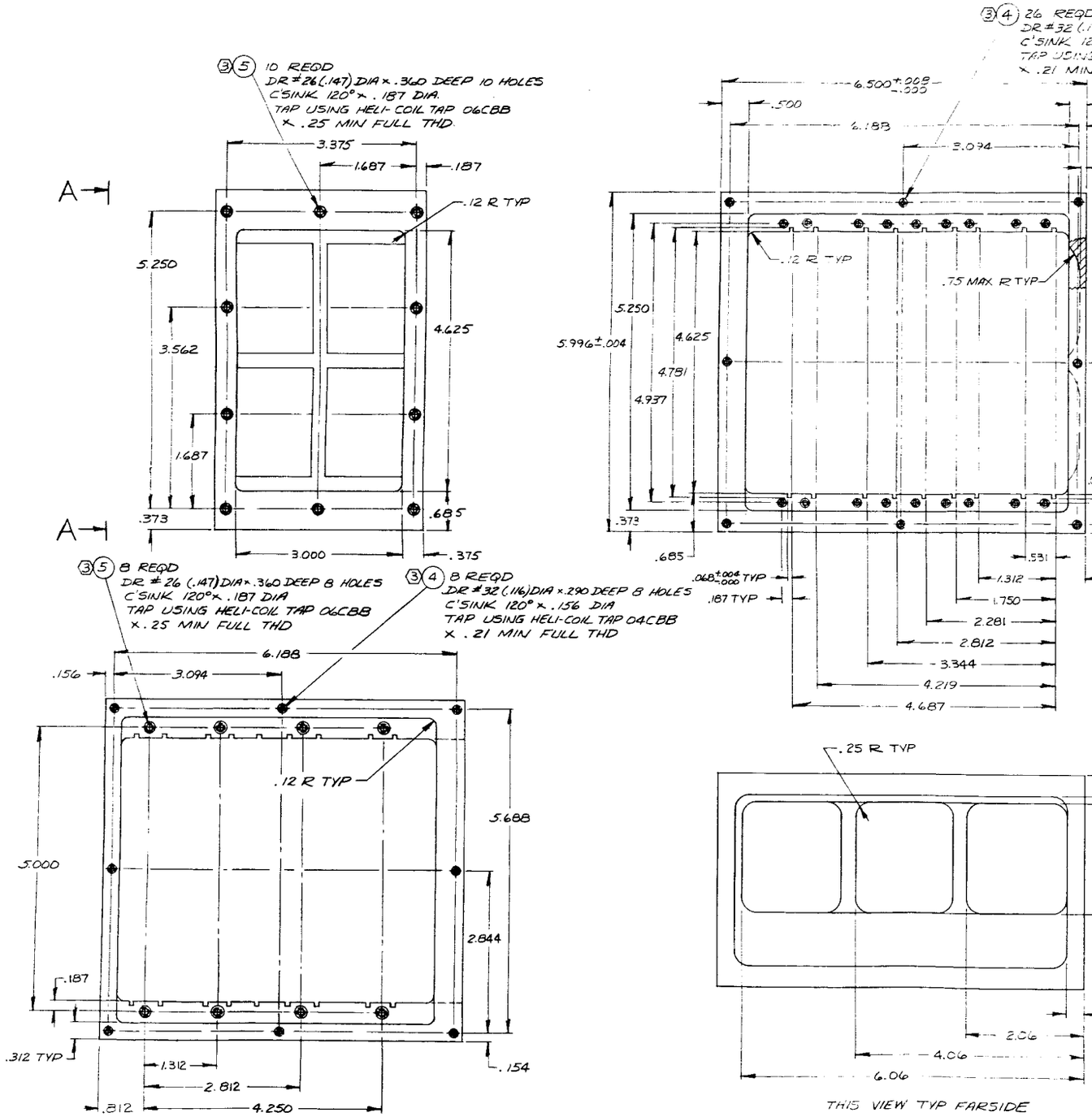
FINISH 1

HEAT TREAT

SURFACE ROUGHNESS PER MIL-STD-10 ✓

SCALE:	SIZE	
1/1	D	11412-203
DO NOT SCALE THIS DRAWING	WEIGHT	SHEET

2


(3)(5) 10 REQD
DR #26 (.147) DIA x .360 DEEP 10 HOLES
C'SINK 120° x .187 DIA
TAP USING HELI-COIL TAP 06CBB
x .25 MIN FULL THD
3.375
1.687
.187
.12 R TYP
5.250
4.625
3.562
1.687
.373
.685
3.000
.375
A
A
(3)(5) 8 REQD
DR #26 (.147) DIA x .360 DEEP 8 HOLES
C'SINK 120° x .187 DIA
TAP USING HELI-COIL TAP 06CBB
x .25 MIN FULL THD
(3)(4) 8 REQD
DR #32 (.116) DIA x .290 DEEP 8 HOLES
C'SINK 120° x .156 DIA
TAP USING HELI-COIL TAP 04CBB
x .21 MIN FULL THD
6.188
.156
3.094
.12 R TYP
5.688
5.000
2.844
.187
.312 TYP
1.312
2.812
4.250
.812
.154
VIEW A-A
(3)(4) 26 REQD
DR #32 (.1
C'SINK .12
TAP USIN
x .21 MIN
6.500 +.008 -.000
.500
6.188
3.094
.12 R TYP
.75 MAX R TYP
5.250
5.996±.004
4.625
4.781
4.937
.373
.685
.068 +.004 -.000 TYP
.187 TYP
.531
1.312
1.750
2.281
2.812
3.344
4.219
4.687
.25 R TYP
2.06
4.06
6.06
THIS VIEW TYP FARSIDE

REVISIONS			
SYM	ZONE	DESCRIPTION	DATE & APPROVAL
		1 MAY BE REWORKED 2 CANNOT BE REWORKED 3 NONE	CHECKED

6) DIA. X .090 DEEP 24 HOLES
0° X .156 DIA.
HEL-COIL TAP C4CBB
FULL THD.

.312
.156

.12 TYP

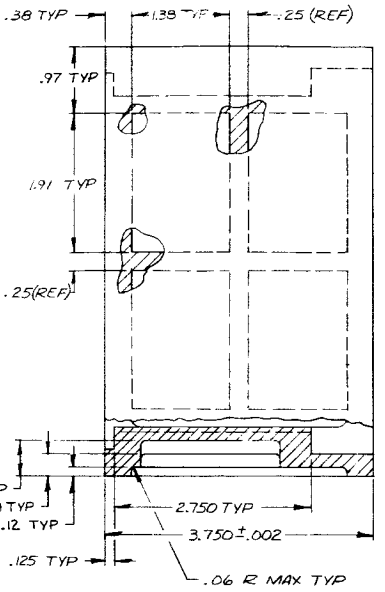
5.688

2.844

.156
.78

.154

.531



.375 TYP

.50

2.44

.31 TYP

ITEM NO	REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION			ZONE
1	5	18	3585-06CNx.207	INSERT			COML
1	4	34	3585-04CNx.168	INSERT			COML
1	1	-3	HOUSING	9.00 DIA. x 3.81	ZK60A-T5 MAG ALY	GQ-M-31	
1	1	11413-203	HOUSING, P.C.B.				

LIST OF MATERIAL OR PARTS LIST

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ± .03 .XXX ± .010
ANGLES ± 0° 30'
DRILLED HOLES
.040 TO .1285: + .002, — .001
.136 TO .228: + .003, — .001
.234 TO .500: + .004, — .001
.515 TO .750: + .005, — .001
.765 TO 1.000: + .007, — .001
1.015 TO 2.000: + .010, — .001

DRAWN	D. MILLER	12-29-65
CHECK	[illegible]	2-1-66
APPD	[illegible]	2-1-66
APPD	[illegible]	[illegible]
FINISH	(2)	
HEAT TREAT		
SURFACE ROUGHNESS PER MIL-STD-10	✓	

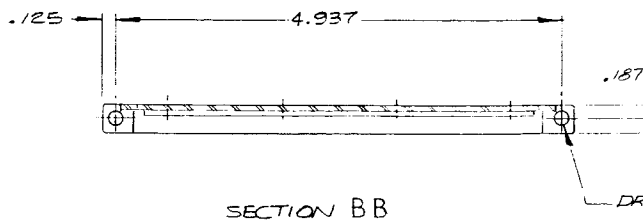
CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

HOUSING P.C.B.
MRIR-PCM

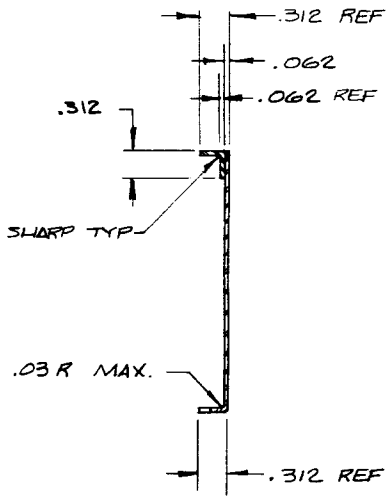
SCALE: FULL
SIZE: F
11413-203
DO NOT SCALE THIS DRAWING
WEIGHT
SHEET 1 OF 1

5. TAG WITH PART NUMBER PER CCP SPEC A0102-001
3. IDENTIFY ALL SURFACES PER NOTE BEFORE INSTALLING.
4. 63, ALL MACHINED SURFACES
3. DOW-17 PER MIL-M-45202, TYPE I, CLASS C
2. HEL-COIL CORP, DANBURY, CONN.
1. MACHINE PER CCP SPEC A0102-001
NOTE: UNLESS OTHERWISE SPECIFIED

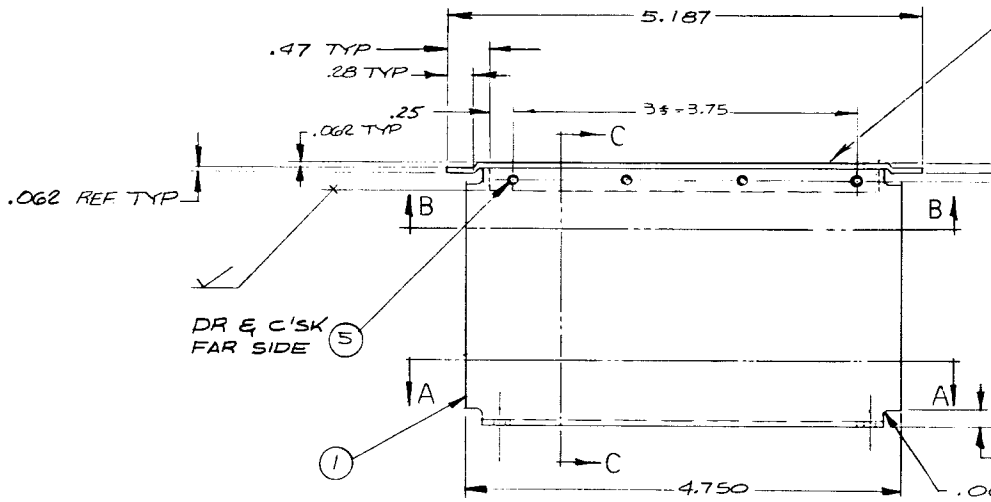
2

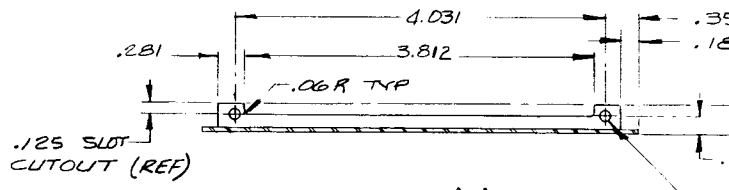


SECTION BB



SECTION CC





SECTION AA

7. IDENTIFY
(2) 6. MAKE FRO
6063-T5
PIONEER AL
5. 125 ALL MA
4. FABRICATE
3. BREAK SHA
(1) 2. CAUSTIC
1. MACHINE PER
NOTE: UNLESS

REVISIONS			
SYM	ZONE	DESCRIPTION	DATE & APPROVAL
		1 MAY BE REWORKED 2 CANNOT BE REWORKED 3 NONE — DISPOS / CLASS	

.312 ±.008 −.015

#29 (.136) 2 HOLES

(3)

63 TYP

.187

2.750

.187 TYP

R TYP

9

7 REF

.312

87

7/8 (.125) DIA HOLES

ER CCP SPEC A0104-001.

M PA 6530 X 5.25

AL ALY EXT.

IM, LOS ANGELES, CALIFORNIA.

CHINE SURFACES.

ER CCP SPEC A0103-001

P EDGES .010-.015.

DIP.

CCP SPEC A0102-001.

OTHERWISE SPECIFIED

ITEM NO	REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION			ZONE
5	4	MS20426AD2-4	RIVET				
3	1	11414-203-5	TEE	(2)	(2)		
1	1	11414-203-3	SHIELD	.06X3.18 X4.81	5052 H32 AL ALY SHT	QQ-A-318c	
ITEM	1	11414-203	SHIELD - PCB				

LIST OF MATERIAL OR PARTS LIST

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03, .XXX ± .010
ANGLES: ± 0° 30'

DRILLED HOLES

.040	TO .1285: +.002, −.001
.136	TO .228: +.003, −.001
.234	TO .500: +.004, −.001
.515	TO .750: +.005, −.001
.765	TO 1.000: +.007, −.001
1.015	TO 2.000: +.010, −.001

DRAWN	A. R. COLL	12-30-65
CHECK	[illegible]	1-21-66
APPD	[illegible]	2-1-66
APPD	[illegible]	

FINISH (1)

HEAT TREAT

SURFACE ROUGHNESS PER MIL-STD-10 ✓

CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

SHIELD - P. C. B.
MRIR P.C.M.

SCALE: 1/1
DO NOT SCALE THIS DRAWING

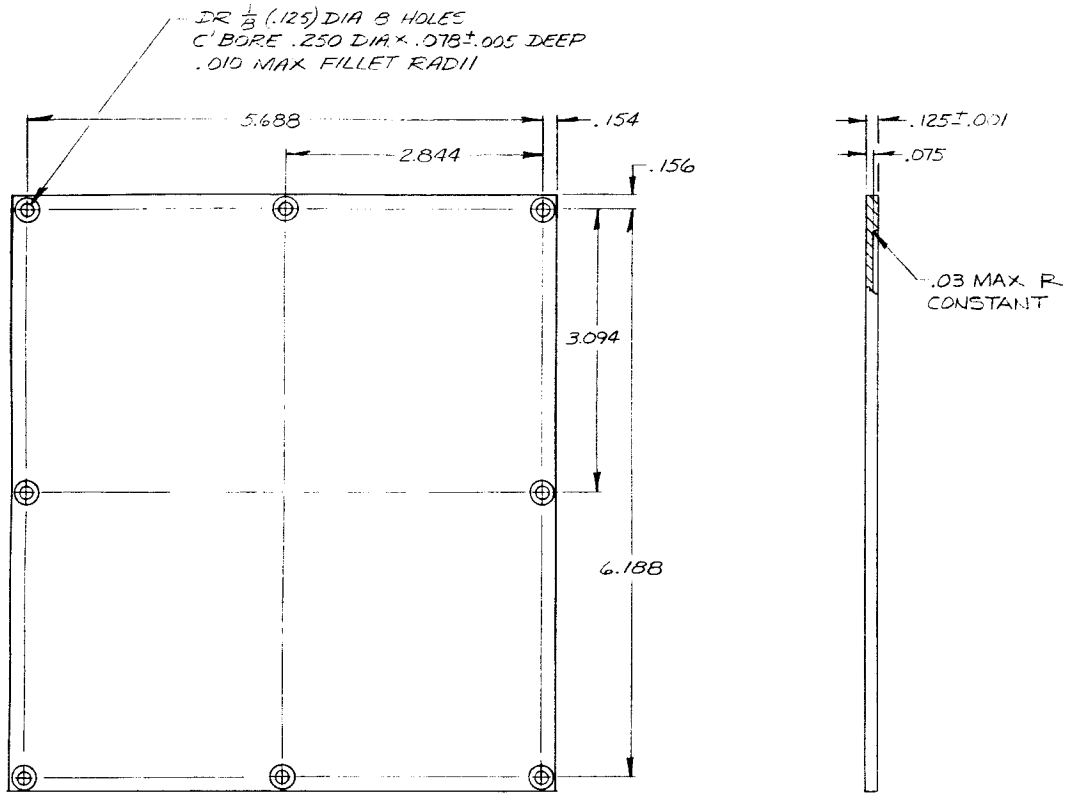
SIZE D

11414-203

WEIGHT

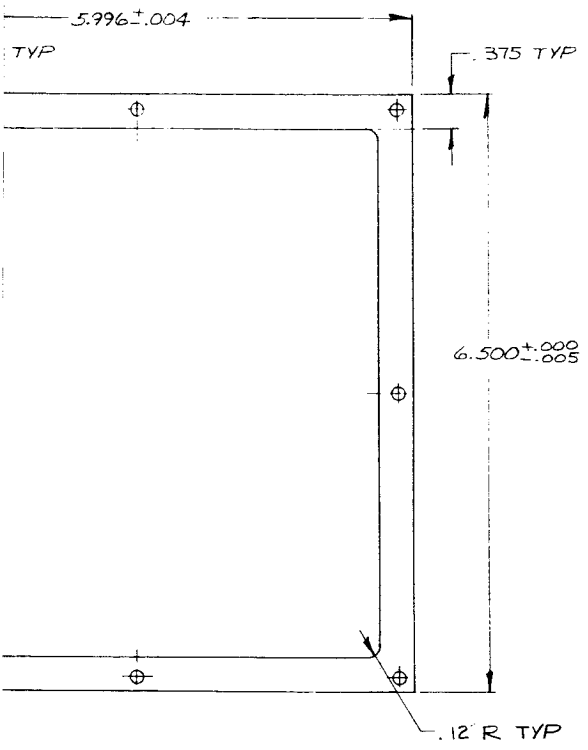
SHEET

2



3. TAG WITH PAR
(1) 2. DOW #17 PE
1. MACHINE PE
NOTE: UNLESS O

REVISIONS			
SYM	ZONE	DESCRIPTION	DATE & APPROVAL
		1 MAY BE REWORKED 2 CANNOT BE REWORKED 3 NONE	



ITEM	REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION	ZONE
	1	11415-203	COVER	.160 × 6.06 × 6.56 AZ31B-H24 MAG. ALY QQ-M-44	

LIST OF MATERIAL OR PARTS LIST

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03, .XXX ± .010
ANGLES: ± 0° 30'

DRILLED HOLES

.040	TO	.1285: +.002, −.001
.136	TO	.228: +.003, −.001
.234	TO	.500: +.004, −.001
.515	TO	.750: +.005, −.001
.765	TO	1.000: +.007, −.001
1.015	TO	2.000: +.010, −.001

DRAWN	D. MILLER	12-29-65
CHECK	R. Hennessy	1-21-66
APPD	J. Miller	2-1-66
APPD	[illegible]	2-1-66

FINISH ⟨1⟩

HEAT TREAT

SURFACE ROUGHNESS PER MIL-STD-10 ✓

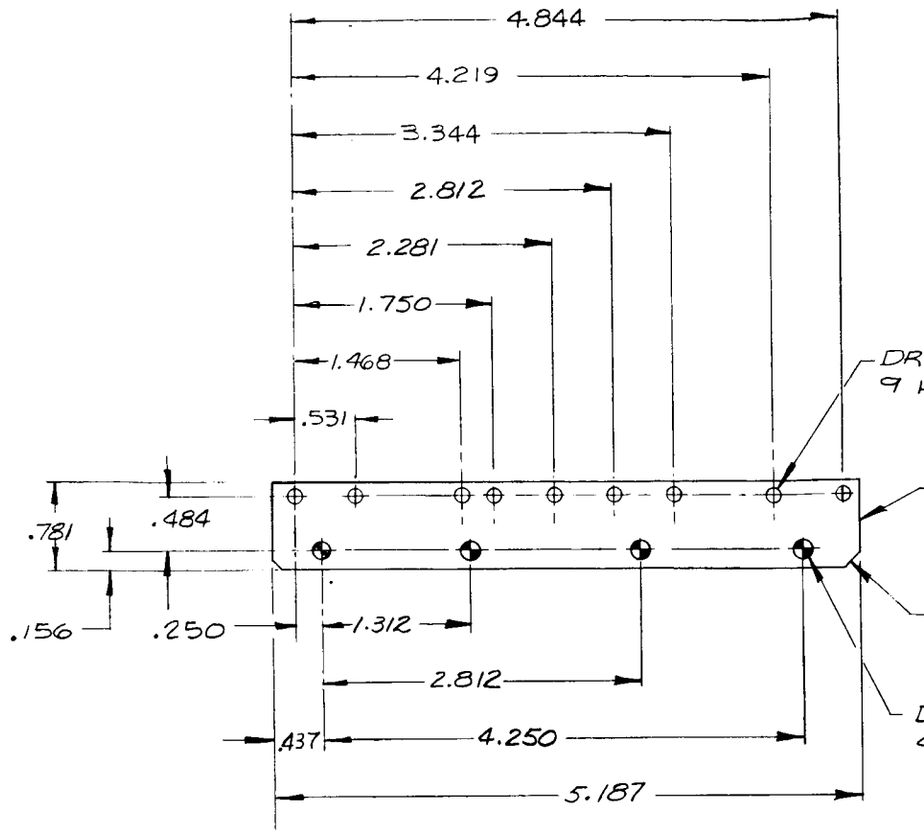
CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

COVER, HOUSING MRIR-PCM

SCALE: FULL
SIZE: D
11415-203
DO NOT SCALE THIS DRAWING
WEIGHT
SHEET 1 OF 1

NO. PER CCP SPEC A0104-001
2 MIL-M-45202 TYPE I, CLASS C
2 CCP SPEC A0102-001
HERWISE SPECIFIED

2



3. TAG WITH PART NO. PER CCP SPEC. A0104-001.
(1) 2. FINISH; DOW#17 PER MIL-M-45202, TYPE I, CLASS C
1. MACHINE PER CCP SPEC A0102-001.
NOTE: UNLESS OTHERWISE SPECIFIED

REVISIONS				
SYM	ZONE	DESCRIPTION	DISPOS	CLASS	DATE & APPROVAL
		1 MAY BE REWORKED 2 CANNOT BE REWORKED 3 NONE			

$\frac{1}{8}$ (.125) DIA
OLES

-.125 THICK

45° X .09 TYP
2 PLACES

R $\frac{5}{32}$ (.156) DIA
HOLES

	REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION	ZONE
	1	11416-203	PLATE-MTG	.125 X.875 X5.250 AZ31B-H24 MAG.ALY QQ-M-44	

LIST OF MATERIAL OR PARTS LIST

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03, .XXX ± .010
ANGLES: ± 0° 30'

DRILLED HOLES

.040	TO .1285	+.002, —.001
.136	TO .228	+.003, —.001
.234	TO .500	+.004, —.001
.515	TO .750	+.005, —.001
.765	TO 1.000	+.007, —.001
1.015	TO 2.000	+.010, —.001

DRAWN	A.R. COLL	12-30-65
CHECK	B Heuer	1-21-66
APPD	D.J. Miller	2-1-66
APPD	D Blair	2-1-66

FINISH (1)

HEAT TREAT

SURFACE ROUGHNESS PER MIL-STD-10 ✓

CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

PLATE—MTG. CONN. MRIR—PCM

SCALE: 1/1
DO NOT SCALE THIS DRAWING

SIZE C | 11416-203

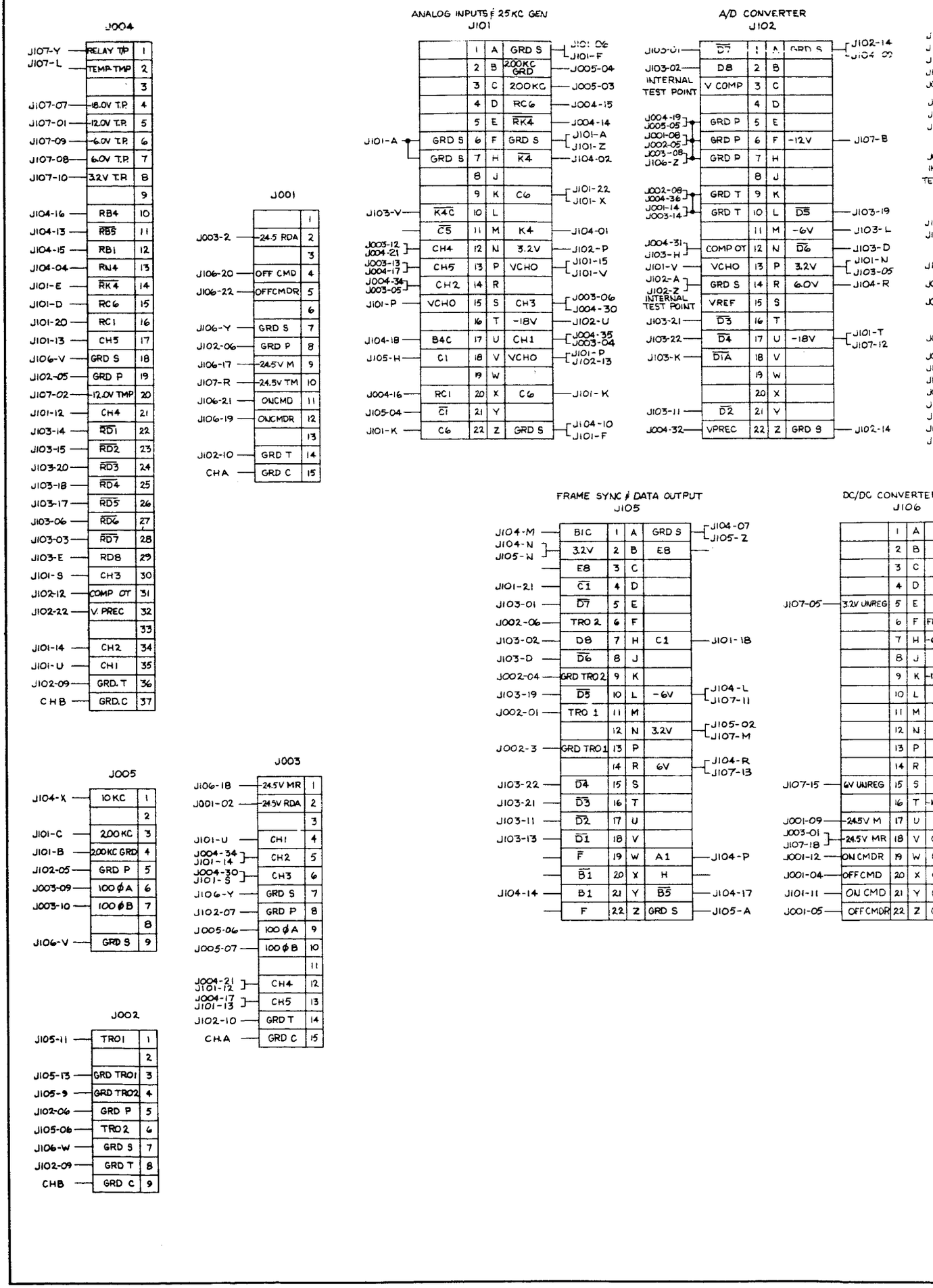
WEIGHT | SHEET

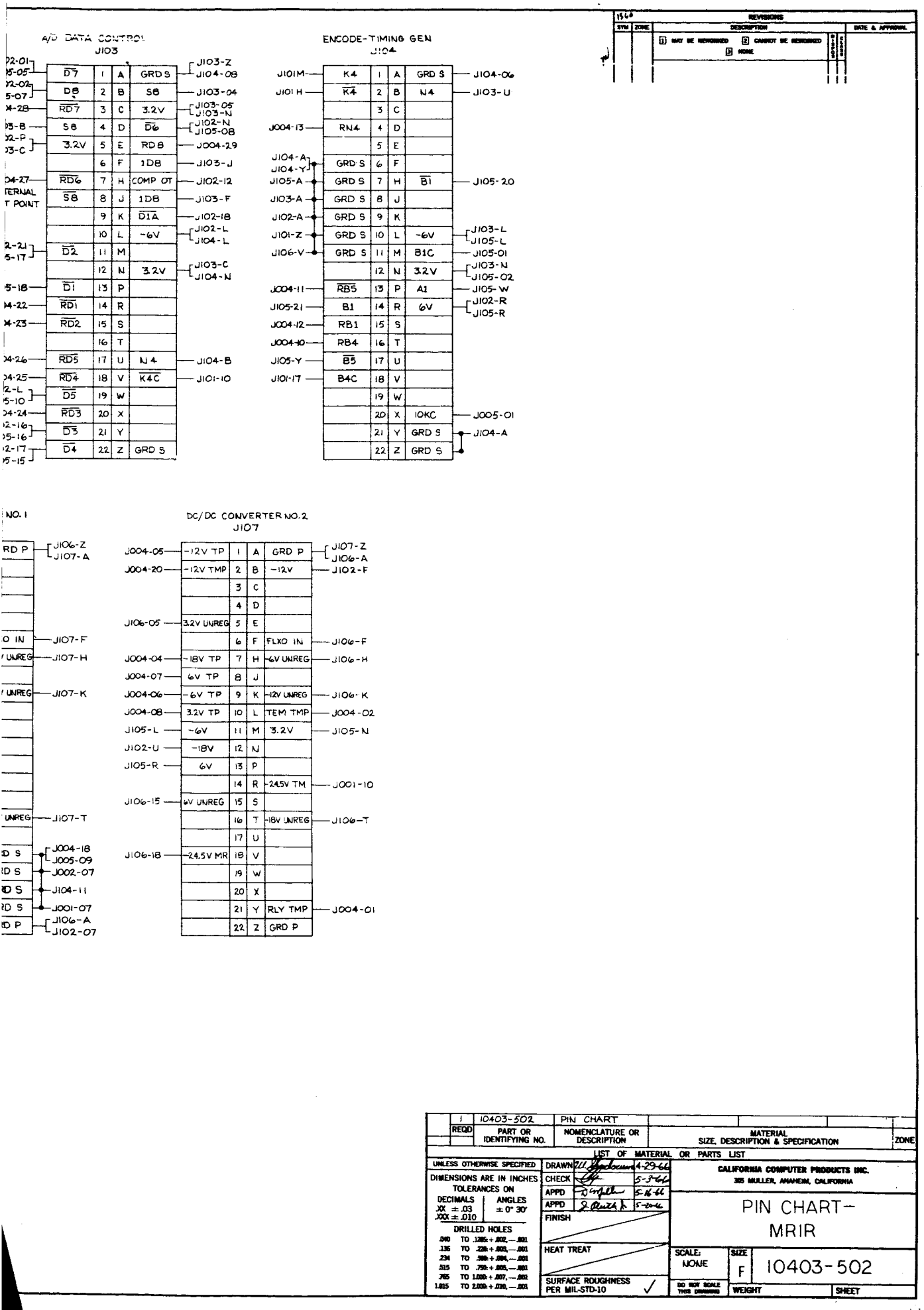
2

APPENDIX D

MRIR TELEMETRY UNIT

PIN CHART


J004
J107-Y
J107-L
RELAY T/P 1
TEMP-TMP 2
3
J107-07 +8.0V T.P. 4
J107-01 +12.0V T.P. 5
J107-09 -6.0V T.P. 6
J107-08 6.0V T.P. 7
J107-10 3.2V T.P. 8
9
J104-16 RB4 10
J104-13 RB5 11
J104-15 RB1 12
J104-04 RN4 13
J101-E RK4 14
J101-D RC6 15
J101-20 RC1 16
J101-13 CH5 17
J106-V GRD S 18
J102-05 GRD P 19
J107-02 -12.0V TMP 20
J101-12 CH4 21
J103-14 RD1 22
J103-15 RD2 23
J103-20 RD3 24
J103-18 RD4 25
J103-17 RD5 26
J103-06 RD6 27
J103-03 RD7 28
J103-E RD8 29
J101-S CH3 30
J102-12 COMP OT 31
J102-22 V. PREC 32
33
J101-14 CH2 34
J101-U CH1 35
J102-09 GRD. T 36
CHB GRD.C 37
J001
J003-2 24.5 RDA 2
3
J106-20 OFF CMD 4
J106-22 OFFCMDR 5
6
J106-Y GRD S 7
J102-06 GRD P 8
J106-17 24.5V M 9
J107-R 24.5V TM 10
J106-21 ONCMD 11
J106-19 ONCMDR 12
13
J102-10 GRD T 14
CHA GRD C 15
ANALOG INPUTS & 25KC GEN
J101
J101-A
GRD S 6 F GRD S
GRD S 7 H K4
8 J
9 K C6
J103-V K4C 10 L
C5 11 M K4
J003-12 J004-21 CH4 12 N 3.2V
J003-13 J004-17 CH5 13 P VCHO
J004-34 J003-05 CH2 14 R
J101-P VCHO 15 S CH3
16 T -18V
J104-18 B4C 17 U CH1
J105-H C1 18 V VCHO
19 W
J004-16 RC1 20 X C6
J105-04 C1 21 Y
J101-K C6 22 Z GRD S
A 1 GRD S
B 2 200KC GRD
C 3 200KC
D 4 RC6
E 5 RK4
J101-06 J101-F
J005-04
J005-03
J004-15
J004-14
J101-A J101-Z
J104-02
J101-22 J101-X
J104-01
J102-P
J101-15 J101-V
J003-06 J004-30
J102-U
J004-35 J003-04
J101-P J102-13
J101-K
J104-10 J101-F
A/D CONVERTER
J102
J103-01 D7 1 A GRD S
J103-02 D8 2 B
INTERNAL TEST POINT V COMP 3 C
4 D
J004-19 J005-05 GRD P 5 E
J001-08 J002-05 GRD P 6 F -12V
J003-08 J106-Z GRD P 7 H
8 J
J002-08 J004-36 GRD T 9 K
J001-14 J003-14 GRD T 10 L D5
11 M -6V
J004-31 J103-H COMP OT 12 N D6
J101-V VCHO 13 P 3.2V
J102-A J102-Z GRD S 14 R 6.0V
INTERNAL TEST POINT VREF 15 S
J103-21 D3 16 T
J103-22 D4 17 U -18V
J103-K D1A 18 V
19 W
20 X
J103-11 D2 21 Y
J004-32 VPREC 22 Z GRD S
J102-14
J103-19
J103-L
J103-D
J101-N J103-05
J104-R
J101-T J107-12
J102-14
FRAME SYNC & DATA OUTPUT
J105
J104-M BIC 1 A GRD S
J104-N J105-N 3.2V 2 B E8
E8 3 C
J101-21 C1 4 D
J103-01 D7 5 E
J002-06 TRO 2 6 F
J103-02 D8 7 H C1
J103-D D6 8 J
J002-04 GRD TRO 2 9 K
J103-19 D5 10 L -6V
J002-01 TRO 1 11 M
12 N 3.2V
J002-3 GRD TRO 1 13 P
14 R 6V
J103-22 D4 15 S
J103-21 D3 16 T
J103-11 D2 17 U
J103-13 D1 18 V
F 19 W A1
B1 20 X H
J104-14 B1 21 Y B5
F 22 Z GRD S
J104-07 J105-Z
J101-18
J104-L J107-11
J105-02 J107-M
J104-R J107-13
J104-P
J104-17
J105-A
DC/DC CONVERTER
J106
J107-05 3.2V UNREG 5 E
J107-15 6V UNREG 15 S
J001-09 24.5V M 17 U
J003-01 J107-18 24.5V MR 18 V
J001-12 ON CMDR 19 W
J001-04 OFF CMD 20 X
J101-11 ON CMD 21 Y
J001-05 OFF CMDR 22 Z
J005
J104-X 10 KC 1
2
J101-C 200 KC 3
J101-B 200KC GRD 4
J102-05 GRD P 5
J003-09 100 ϕ A 6
J003-10 100 ϕ B 7
8
J106-V GRD S 9
J003
J106-18 24.5V MR 1
J001-02 24.5V RDA 2
3
J101-U CH1 4
J004-34 J101-14 CH2 5
J004-30 J101-S CH3 6
J106-Y GRD S 7
J102-07 GRD P 8
J005-06 100 ϕ A 9
J005-07 100 ϕ B 10
11
J004-21 J101-12 CH4 12
J004-17 J101-13 CH5 13
J102-10 GRD T 14
CHA GRD C 15
J002
J105-11 TRO1 1
2
J105-13 GRD TRO1 3
J105-9 GRD TRO2 4
J102-06 GRD P 5
J105-06 TRO2 6
J106-W GRD S 7
J102-09 GRD T 8
CHB GRD C 9



REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SIZE, DESCRIPTION & SPECIFICATION		ZONE
1	10403-502	PIN CHART			

LIST OF MATERIAL OR PARTS LIST

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03, .XXX ± .010
ANGLES: ± 0° 30'
DRILLED HOLES
.040 TO .1285 +.002, —.001
.136 TO .228 +.003, —.001
.234 TO .500 +.004, —.001
.515 TO .750 +.005, —.001
.765 TO 1.000 +.007, —.002
1.015 TO 2.000 +.010, —.003

DRAWN W. Jackson 4-29-66
CHECK [illegible] 5-5-66
APPD [illegible] 5-16-66
APPD [illegible] 5-20-66
FINISH
HEAT TREAT
SURFACE ROUGHNESS PER MIL-STD-10 ✓

CALIFORNIA COMPUTER PRODUCTS INC.
305 MULLER, ANAHEIM, CALIFORNIA

PIN CHART—
MRIR

SCALE: NONE
SIZE: F
10403-502
DO NOT SCALE THIS DRAWING
WEIGHT
SHEET